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E4N

manual for use and programming (V 2.72)

This product complies with following European and US standards:

EN61010-1 (SAFETY)
EN61326-1 (EMC)

47CFR Subpart C

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required
to correct the interference at his own expense.

Code of manual: D2040027U1
Department: TESTAR DIVISION
Issue: 11/2008
Software release: 2.72

MARPOSS SpA does not undertake to notify any subsequent changes in the product.

The descriptions contained in this manual do not authorize any tampering by unauthorized personnel.

The warranty on the equipment becomes void as soon as such a tampering is found.

Important: Dangerous voltages are present within this apparatus, therefore the mains plug must be disconnected before opening the apparatus.

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Preface

This manual is meant for all those who must install, program and use the E4N column. Its purpose is to allow them to make the best possible use of the characteristics of this product, in order to achieve increasingly high levels of quality.

The manual is divided into the following chapters:

- **Introduction.** This chapter contains a description of the technical and functional characteristics of the equipment, of its front and back view, and of its overall dimensions.
- **Installation of E4N column.** This chapter describes the installation of the equipment and the connection of the measuring devices and of the accessories.
- **Operating modes of E4N column.** This brief chapter supplies an introduction to the operating modes of the column.
- **Programming of E4N column.** This chapter describes the programming of the column, and includes, at the end, two examples of the programming.
- **Adjustment mode (ADJ).** This chapter describes the procedure for achieving or restoring the correct mechanical positioning of the measuring sensors associated to the column.
- **Calibration.** This chapter describes the calibration of the column and the setting of the mechanical part associated to it.
- **Use of E4N column.** This chapter supplies a description of the use of the column, that is to say of its operation from the point of view of the end user.
- **Programming error messages.** This chapter contains a list of the error messages, of their possible causes, and of the actions suggested for their elimination.
- **Appendix A. Sheets for programming of E4N column.** This appendix contains some programming sheets that will be useful as a guide to an orderly programming of the column.
- **Appendix B. Programming Flow Chart**. Two Flow Charts are supplied to provide a simple approach to programming.

Note

All the implementations made to release V 2.1 are identified by symbol '*' on the left-hand margin of text.

All the implementations made to release V 2.3 are identified by symbol '§' on the left-hand margin of text.

All the implementations made to release V 2.72 are identified by symbol '£' on the left-hand margin.

CE

This product is in conformity with the EMC requirements as per the directives:

89/336/EEC dated 3.05 1989

92/31/EEC dated 28.04 1992

93/68/EEC dated 22.07 1993

This product is intended to operate in industrial locations; it is not intended for connections to a public mains network but is intended to be connected to a power network supplied from a high or medium voltage transformer.

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Chapter 1. Introduction

1.1 General Information

The E4N column is an electronic gauge amplifier for the manual inspection, both in static and in dynamic mode, of mechanical parts, and for the determination of their status or class.

It is:

MODULAR: because several columns can be assembled in order to obtain a composition capable of solving measuring problems that are too complex to be solved by only one column;

CONFIGURABLE: because the range of available modules makes it possible to configure the gauge for various different needs, both in the number of sensors and in the type;

FLEXIBLE: all its functions are under software control.

The front panel contains, besides the pushbuttons for the functions, all the indications that the operator needs to identify the result of the measurement, the programmed measurements and the alarms.

The ***LED scale*** is in three colors and can take on the following colors, depending on the status of the measurement: red, yellow and green.
So it is very easy for the operator to determine whether the dimension is within tolerance: red means that it is out of tolerance, yellow that it is pre-scrap, and green is within tolerance. The operator can program the limits associated to the colors, via the software, in any position within the measuring range.

The software and the programming procedures are independent of the selection of the main unit and of the options.

The front panel contains ***two digital displays***, respectively above and below the measurement scale.

The upper display, which has four digits, the sign and a floating decimal point, displays the selected measurement range, the resolution, the error messages, and the operating mode.

The lower display, which is alphanumerical and has the sign and a floating decimal point, belongs to the ***local programming module***. It displays, in digital mode, the value of the measurement indicated by the scale with LEDs. It can be programmed to display either the absolute or the relative measurement. This display, together with five pushbuttons under it, is used during the programming to display the programming instructions.
As an alternative to the column with local programming module there is also available a version with a ***module for remote programmer*** equipped with two pushbuttons and a connector for its connection to a **remote programmer**. This makes it possible to have several columns and a single remote programmer.

The lower part of the column contains the ***module for the amplification of the signal of the sensors***. These modules are removable and interchangeable; they make it possible to connect both inductive sensors (LVDT and HBT), extensometer sensors (MRT), and air/electronic (AIR).

The rear panel is equipped with input and output connectors for the transfer of the sensor signals from one column to another and for the connection of external pushbutton panels, a printing unit, a personal computer, a statistical analyzer, a group of résumé lamps or an external logic for selection into classes or for controlling peripheral devices.

The column is equipped with a ***self-diagnosis (SELF TEST)*** function which is activated at power-on and verifies the correctness of the operation of all the parts; if a fault is found, an error message is displayed.
During its operation, the column verifies the correctness of the operation of the transducers that are connected to it. If there is an interruption in the cable or in the transducers, or if the measuring cells are disconnected from the column, an alarm condition is generated.

The column can carry out:

- a static measurement;
- a dynamic measurement;
- two static measurements with management of the displaying of the measurement on the scale by means of an automatic switching between the two measurements.

The column is equipped with a **ZERO SHIFT** function which makes it possible, using the same master gauge, to measure workpieces that have the same geometric characteristics but different dimensions, at least within the range of linearity of the sensor that is being used. Two zero-shifts can be applied to the measurements, so the total is three different types of workpieces.

1.2 Technical Specifications

General:

Storing temperature	-40 / +60 °C
Operating temperature	0 / +50 °C
Watertightness	IP 50
§ § § § Electromagnetic susceptibility	Directives 89/336/EEC Directives 92/31/EEC Directives 93/68/EEC Norms EN 50081-2 Norms EN 50082-2
Power supply	85/265 Vac 50/60 Hz
Maximum input	40 VA
Fuse	2 A - slow-blowing
MTBF (Medium Time Between Failures)	>100.000 hours
Average life of display -normal brightness -maximum brightness	 >100.000 hours >50.000 hours

Performance:

Time for stabilization after power-on	5 minutes
Variations of measurement in relation to temperature	100 PPM/°C
Relative variation of measurement in the channels in relation to temperature	30 PPM/°C
<u>E4N equipped with LVDT-HBT-MRT sensors</u> Measuring accuracy at 20°C Resolution = 0.1 μm [1]	 $\pm$0,5% $\pm$ resolution
<u>E4N equipped with AIR/ELECTRONIC sensors</u> in the nominal conditions: Air pressure supply Working range	 3 bar $\pm$ 30μm
Repeatability Accuracy	2.77 σ = 0.7μm 1.5μm

[1] Resolution = 0.1 μm in the following conditions:

- 1 measuring channel
- transducer type = normal
- range of transducer = $\pm$250 μm
- coefficient of arm ratio = 1
- coefficient of measurement = 1

INTERFACES:

Analog output:

Ranges	± 2.4 V F.S. ± 10 V F.S.
Full scale	like bargraph
Accuracy	2% of full scale

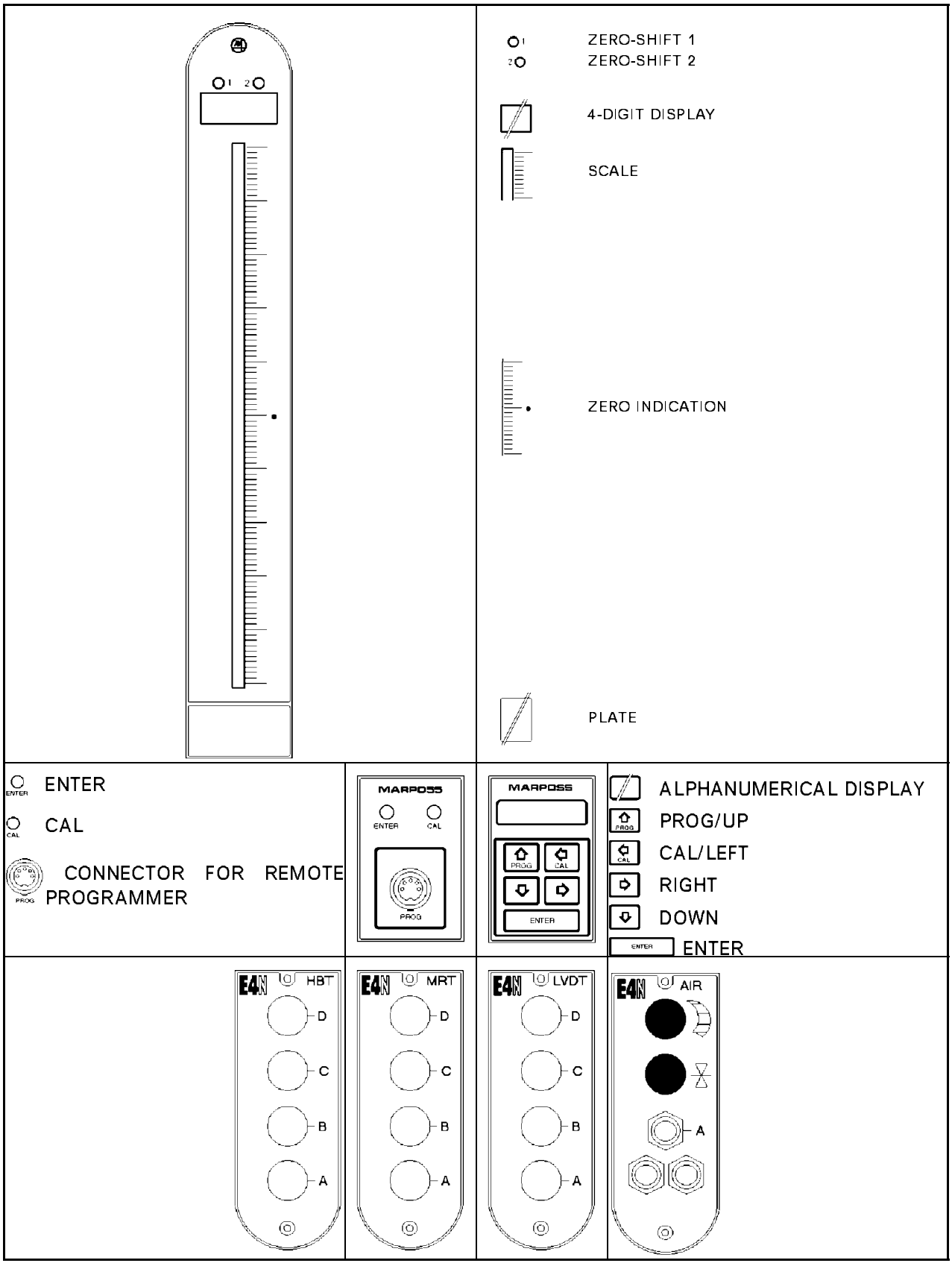
Serial output:

Physical level	RS232C
Baud rate	300, 600, 1200, 2400, 4800, 9600
Number of bits	7 or 8
Parity	None, even, odd
Handshake	none, hardware, XOn/XOff,

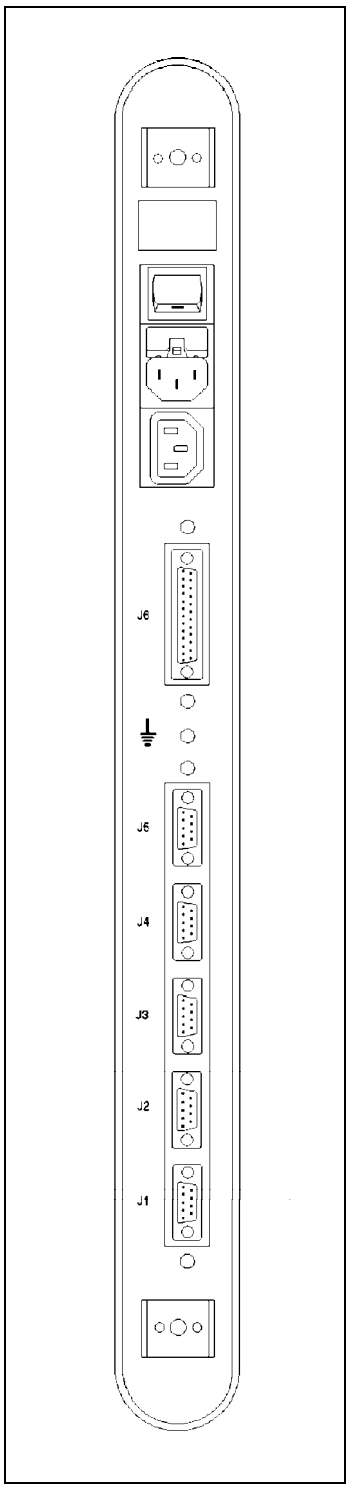
Relay output:

Contacts	
-Maximum power	3 VA
-Maximum voltage	48 V
-Maximum current	2 A

1.3 Front View



1.4 Rear View



£ Figure 1. Rear view



Supporting hooks



Plate



Power supply switch



Fuse



Connector for power supply input



Connector for power supply output

J6 25-pole female CANNON connector for résumé lamps or BCD output for sorting into classes (optional)

J5 9-pole female CANNON connector for an external pushbutton panel

J4 9-pole male CANNON connector for serial RS232 interface

J3 9-pole female CANNON connector for Digimatic interface and analog output

J2 9-pole female CANNON output connector for bus for transfer of sensor signals and synchronism signals

J1 9-pole male CANNON input connector for bus for transfer of sensor signals and synchronism signals



Ground pin

1.5 Overall dimensions.

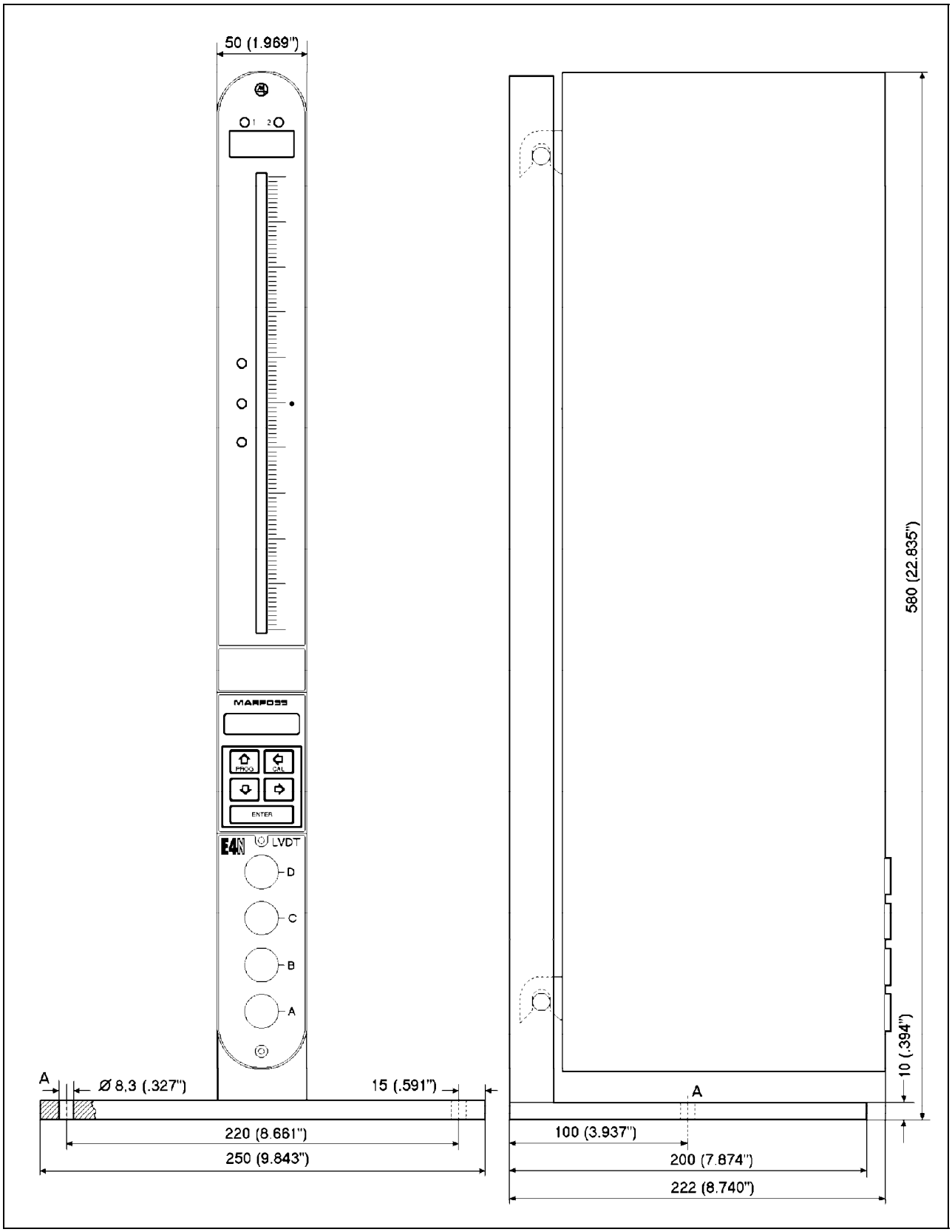


Figure 2. Side and front view with the overall dimensions expressed in millimeters and inches in brackets.

Chapter 2. Installation of E4N Column

This chapter supplies the information required for the installation of the E4N column.

The case of the installation of a single column and that of the installation of an assembly of several columns are explained at the same time.

§ **IMPORTANT REMARK:**

§ The plugs can be removed from the connectors only to fit the relevant connector.

2.1 Mechanical Installation

The E4N column can be mounted either individually or in more complex assemblies. In both cases it is necessary to use the expressly-devised stand, which can accept up to five columns. Figure 3 shows the stand, the elements which belong to it and those that are required to expand it.

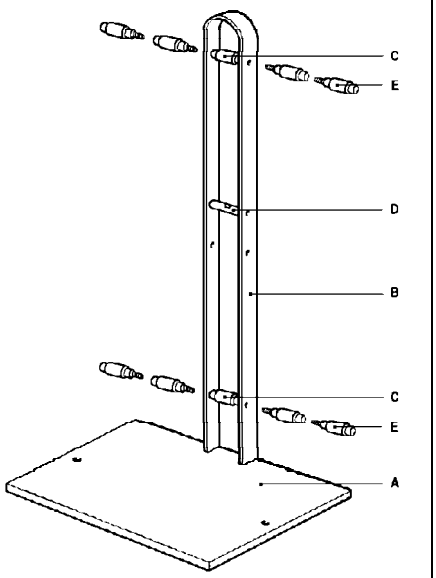


Figure 3. Stand

A base, with holes for fastening to the bench;

B support;

C pins for hanging the module;

D reinforcement pin;

E hanging pins for expanding the stand.

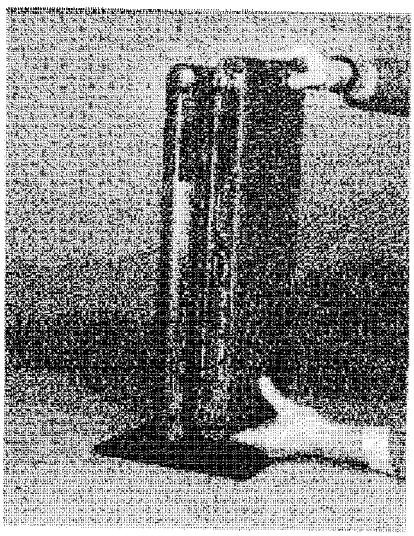


Figure 4. Assembly of several columns on the stand

The expansion of the stand is obtained by mounting the appropriate number of hanging pins (E).
When this operation has been completed, the modules that form the composition can be mounted.
The modules are numbered progressively left to right, seeing frontally the composition. During the assembly, this order must be respected in order to avoid problems with the length of the connection cables.
Mount one module at a time, proceeding as follows:

1. keep the module vertical;
2. place the upper and lower hooks on respective pins (C) and (E);
3. press the module down until the hooks are hitched to the pins.

2.2 Connection to power supply

The E4N column adjusts itself to the power supply voltage, provided it is between 85 and 265 Vac 50/60 Hz.

§ If there is only one column, plug the power supply cable into the appropriate socket (see Figure 6 on page 12 for the Marposs identification codes) and connect the earth pin (ref. 1, Figure 6 on page 12).

If there is a composition of modules, connect the first column to the power supply, then connect the columns to each other by means of the cables with Marposs code 6739696029 (Figure 6 on page 12). The composition is switched on by acting on the switch on the first module. The switches of the other modules must be kept always in position ON (see Figure 5 on page 12).

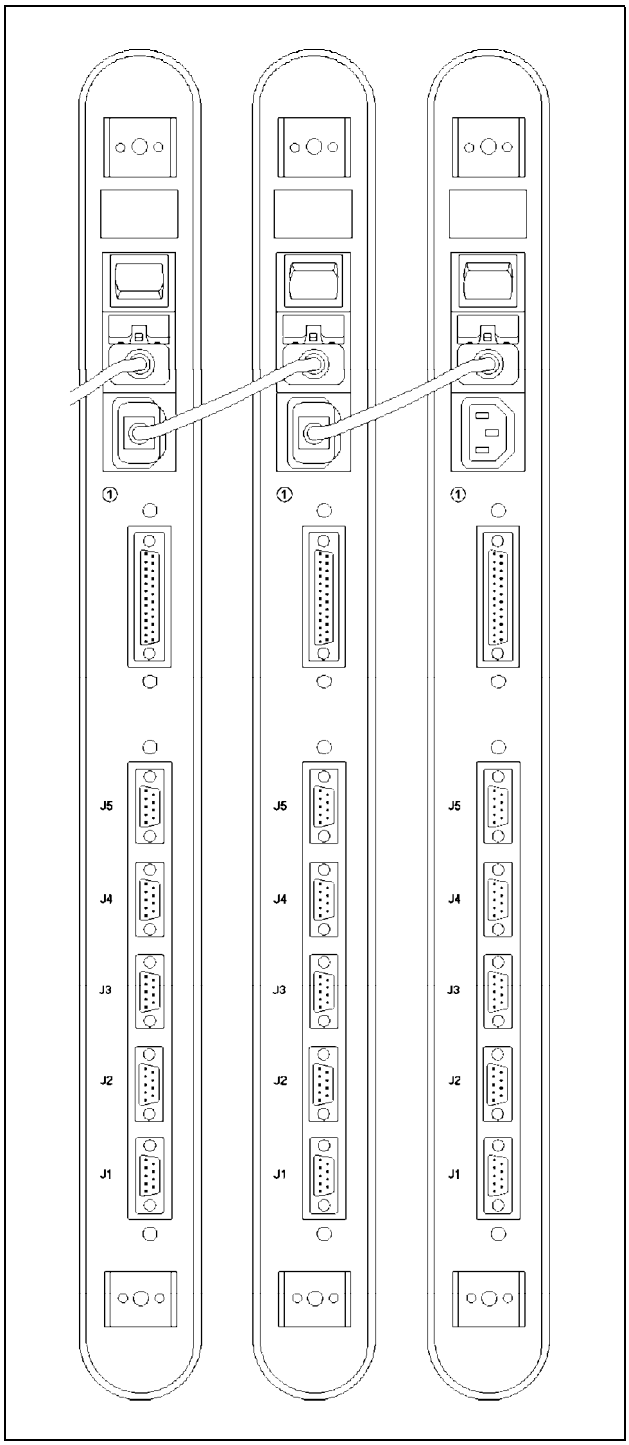


Figure 5. Connection of E4N column to network

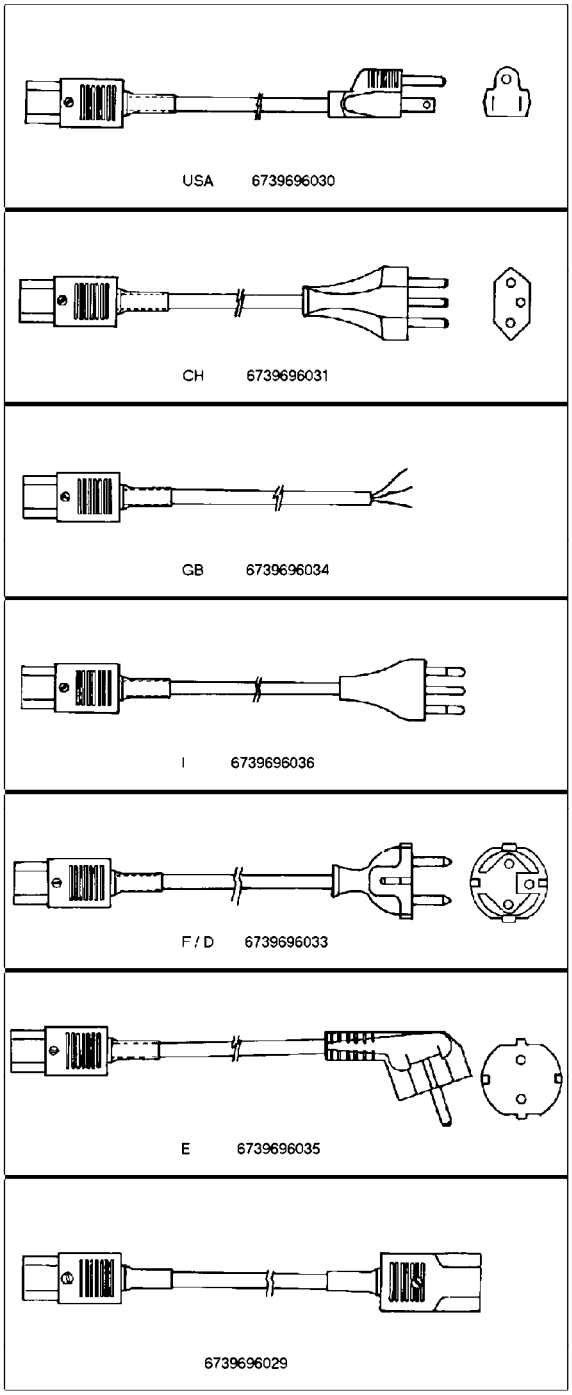


Figure 6. Network cables of E4N column

§ For compliance to safety standards DIRECTIVE 72/23/EEC (LOW VOLTAGE) NORM CEI - EN 60950 2 and
§ : CEI - EN 60950 A1, on the rear of the column there is a pin that must be connected to the EARTH
§ connector.

2.3 Connection to the air supply network

In case of E4N column with air/electronic sensor, the connection to the air supply network must be foreseen.
The power-supply air, before reaching the air electronic sensor, has to be filtered, dehumidified and stabilized. In particular, the power-supply air reaching the column must have a pressure with a value between 1.5 and 4 bars. This means that the power supply pressure, once the application has been defined and the mechanic+electronic assembly has been adjusted, must be **stable**. In fact, within an application, the tolerance of the power-supply pressure may be of max. 3% of the nominal value.
In order to face such needs the **filtering and adjusting** unit has been developed (Marposs code 2915490053); such group is comprehensive of:

- FILTER+PRESSURE REDUCER unit; the filter is at the best of 5μm. The maximum pressure at the pressure reducer unit input can be of 10 bars.
- MANOMETER; to adjust the air pressure.
- OPEN/CLOSE VALVE
- SILENCER unit
- MECHANIC CONNECTION BLOCK
- QUICK CLUTCH NIPPLO;
- FLEXIBLE HOSE;
  - outside diameter = 6mm
  - inside diameter = 4mm
  - lenght = 1.5m
- SUPPORT; it allows to fix all the unit to the rear part of the E4N support.

* The group is able to supply two E4N columns.
The commercial components are by SMC.
* The "filtering and adjusting" unit foresees a threaded hole on the side of the network air **(1/4 gas).**

Please find here following the lay-out relevant to the above described unit mounted on the E4N support.

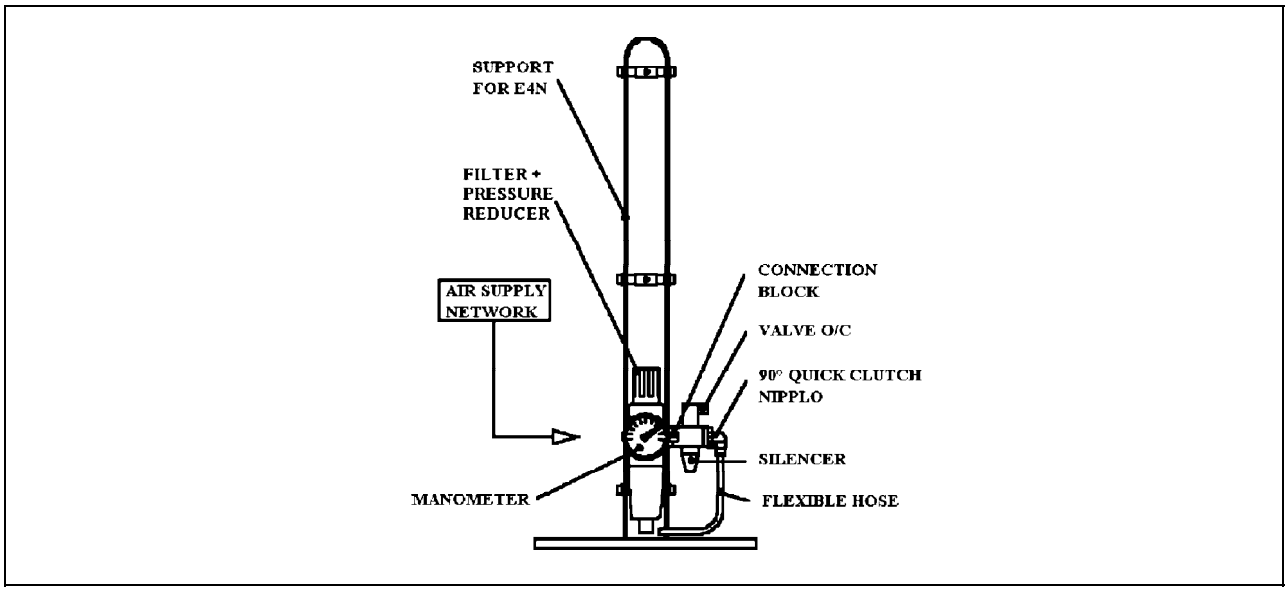


Figure 7. Rear view of the filtering and adjusting unit

The column connection to the air supply network is showed on Figure 8 on page 14 where the E4N column is supplied by means of the hose connected to a quick clutch nipplo.

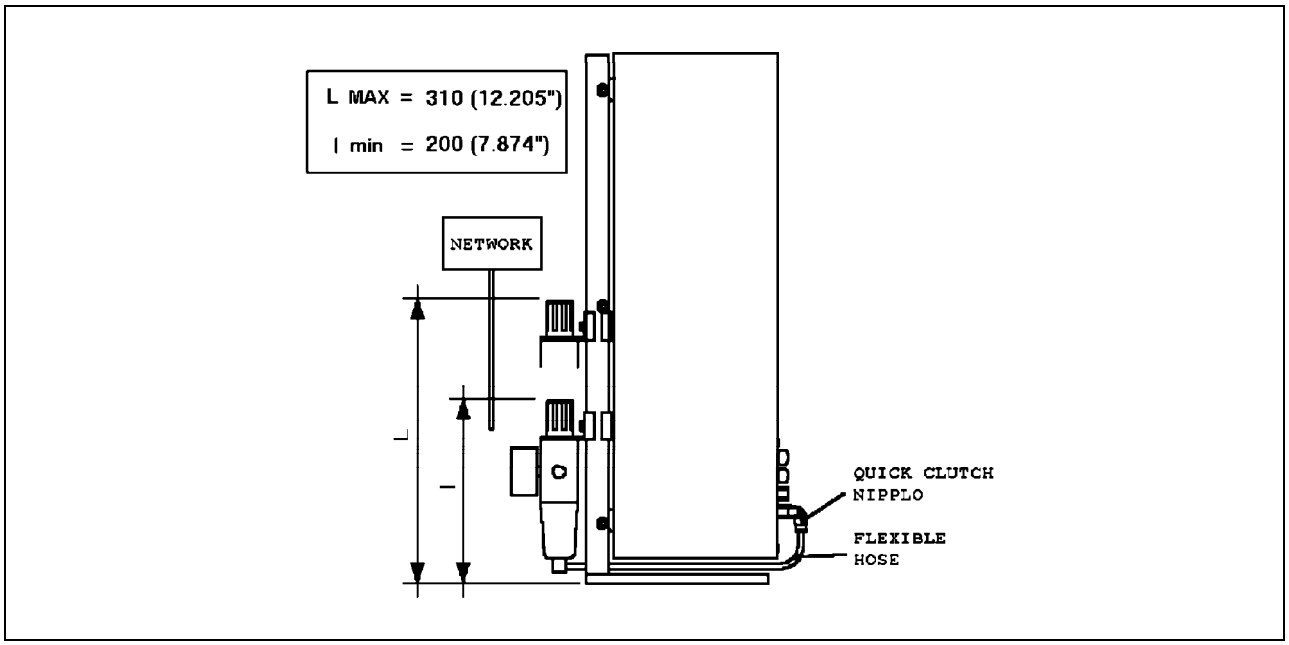


Figure 8. Side view of the filtering and adjusting unit

Such a connection can be performed in the following ways:

a. the hose is fixed to a 90° quick clutch nipplo which is useful to direct the hose depending on one's needs.

* The nipplo must be fixed on the air supply connection (threaded 1/8 gas or threaded 1/8 NPT) present on the A/E amplifier module.

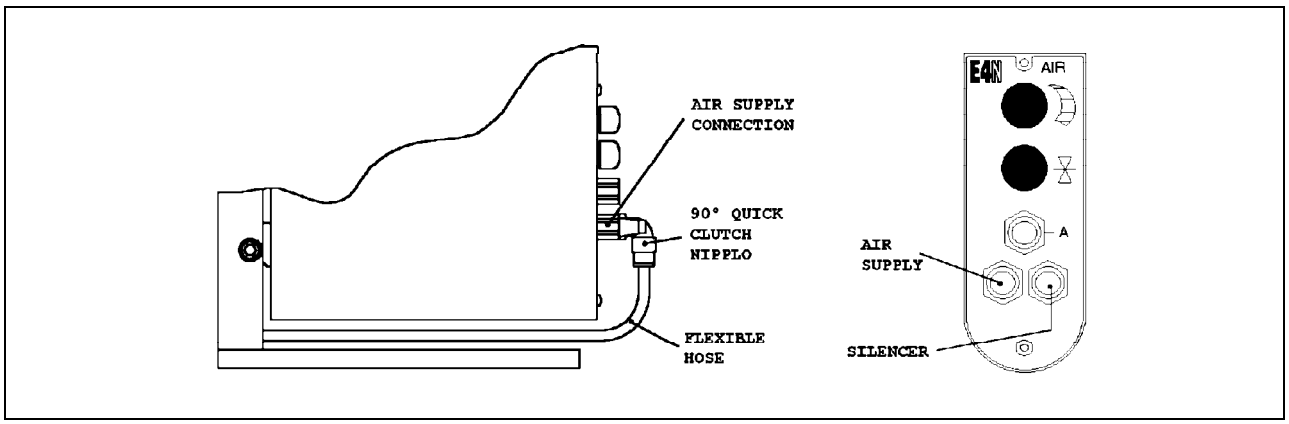


Figure 9. Connection to the 90° quick clutch nipplo

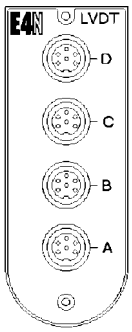
* Marposs code 2915490052 is comprehensive of two 90° quick clutch nipplos (for a hose of 6x4mm) perfectly compatible with the E4N air supply connection metric version (i.e. threaded 1/8 gas).

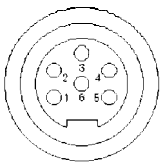
b. the hose is fixed on a straight quick clutch nipplo which must be fixed on the air supply connection (threaded 1/8 gas or threaded 1/8 NPT).

* The Marposs code 2915490050 is comprehensive of two straight clutch nipplos perfectly compatible with the E4N air supply connection metric version (i.e. threaded 1/8 gas).

2.4 Connection of measuring sensors.

Below there are indicated, for each module for the amplification of the sensor signals, the relevant connector on the panel of the module, its connections and the installation procedure. The amplifier modules are supplied with the connectors expressly protected by means of special screw caps. Such plastic caps must be kept on those connectors not employed.

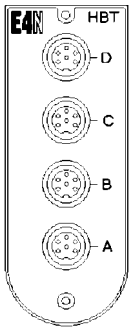


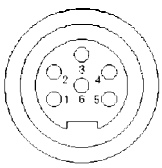
LVDT		
CONNECTOR	**PIN**	**SIGNAL**
	1	OSCILLATOR
	2	GROUND (OSCILLATOR)
	3	NOT CONNECTED
	4	GROUND (SIGNAL)
	5	SIGNAL INPUT
	6	NOT CONNECTED

AMPLIFIER MODULE for LVDT sensors; 3 versions are available:

- 1 CH LVDT
- 2 CH LVDT
- 4 CH LVDT

The connector is a KFR60 for screw plug SV50/6.
To make the connection: after unscrewing the guarding cap, gently push the plug into the connector and screw it in completely.

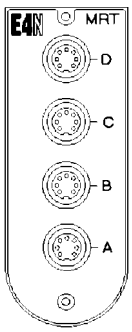


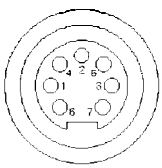
HBT		
CONNECTOR	**PIN**	**SIGNAL**
	1	OSCILLATOR
	2	GROUND
	3	SIGNAL INPUT
	4	NOT CONNECTED
	5	OSCILLATOR
	6	NOT CONNECTED

AMPLIFIER MODULE for HBT sensors: 3 versions are available:

- 1 CH HBT (MARPOSS-TESA)
- 2 CH HBT (MARPOSS-TESA)
- 4 CH HBT (MARPOSS-TESA)

The connector is a KFR60 for screw plug SV50/6.
To make the connection: after unscrewing the guarding cap, gently push the plug into the connector and screw it in completely.

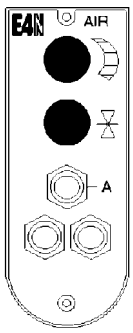


MRT		
CONNECTOR	**PIN**	**SIGNAL**
	1	SIGNAL INPUT
	2	NOT CONNECTED
	3	GROUND
	4	+VRP POWER SUPPLY BRIDGE
	5	NOT CONNECTED
	6	+VP POWER SUPPLY
	7	-VP POWER SUPPLY

AMPLIFIER MODULE for MRT sensors; 3 versions are available:

- 1 CH MRT
- 2 CH MRT
- 4 CH MRT

The connector is a KFR71 for screw plug SV71.
To make the connection: after unscrewing the guarding cap, gently push the plug into the connector and screw it in completely.



AMPLIFIER MODULE for AIR/ELECTRONIC sensor; 2 versions are available:

Metric version
The A letter on the panel identifies the connection for the air gauge. To this connection (threaded 1/8 GAS) a compatible quick clutch nipplo must be fixed.

Imperial version
The A letter on the panel identifies the connection for the air gauge. To this connection (threaded 1/8 NPT) a compatible quick clutch nipplo must be fixed.

For the connection, push the "air hose" into the quick clutch nipplo. As this connection makes it possible to supply the air to the gauge, it is necessary that such a connection is airtight (paragraph 5.2, "Adjusting procedure for AIR/ELECTRONIC sensors" on page 81).

The amplifier module for air/electronic sensor, for both versions, can be provided with "protection covers":

- protection cover for sensitivity knob
- protection cover for sensitivity and zero knobs

Such covers avoid the operator to accidentally alter the application set-up.

The covers have to be assembled on the amplifier modules exploiting the upper fixing screw of the same modules.

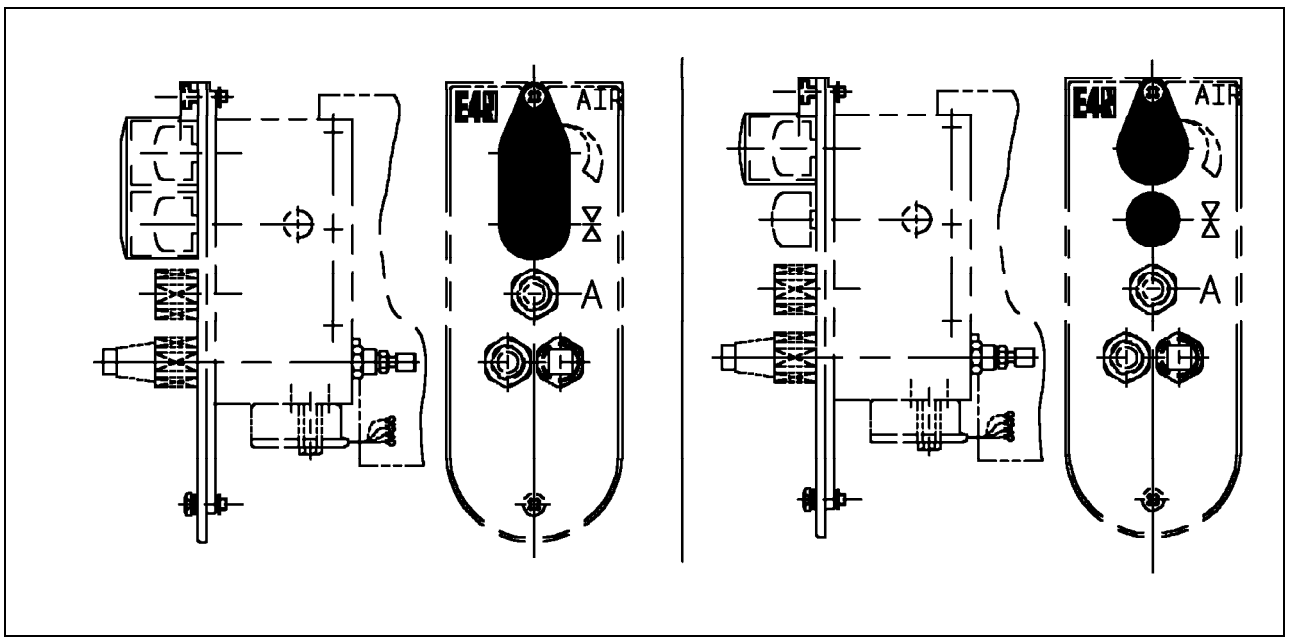


Figure 10. Lay-out with both the codes

2.5 Connection of an external pushbutton box and/or footswitch to one E4N column

Figure 11 shows connector J5 and the connection of four external pushbuttons or switches. To the right there are indicated the signals present in the *pins* of this connector.

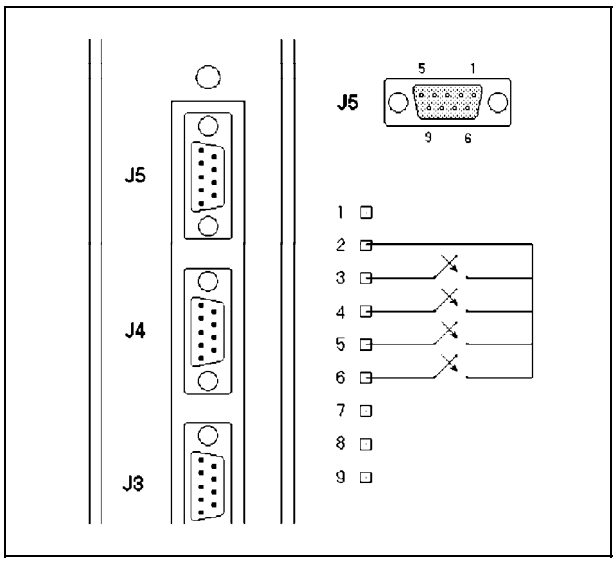


Figure 11. Connector and connections for pushbutton panel

PIN	SIGNAL
1	SHIELD
2	SIGNAL GROUND
3	Z_SHIFT (ZEROING)
4	HOLD (1) / DIN_ELAB (2)
5	SEND
6	RUN (ZEROING)
7	NOT CONNECTED
8	NOT CONNECTED
9	NOT CONNECTED

Note:

1. active for static measurements;
2. active for dynamic measurements.

EXTERNAL PUSHBUTTON BOX

The external pushbutton box (code 6139010500), equipped with four pushbuttons, is available as a component of the E4N.
The meaning and operation of the pushbuttons depend on the mode of acquisition of the measurement (static or dynamic) that has been programmed.

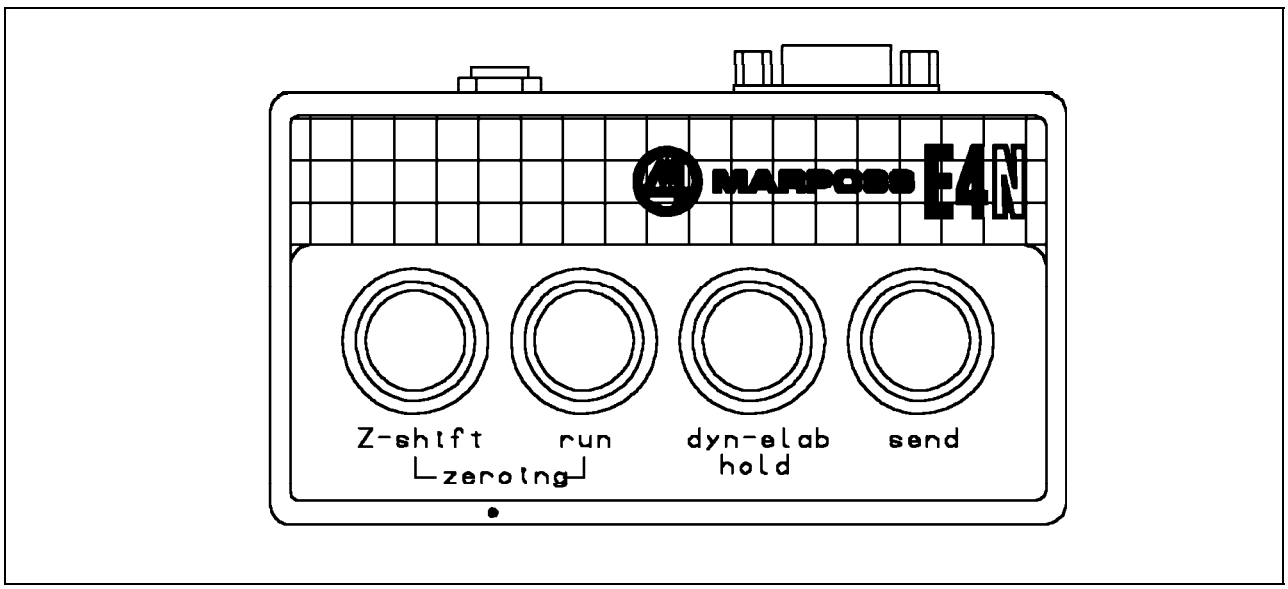


Figure 12. External pushbutton panel

Static measurement:

HOLD if the contact is closed, it holds the measurement value; the display on the top indicates HOLD;

SEND the closing of the contact controls the transmission of the measurement value to the enabled serial interface; during the transmission and for at least 0.5 seconds, the display on the top indicates SEND; if the measurement is held, only one transmission is accepted;

Z-SHIFT it selects the zero shift; the zero shift that is active is the one indicated by the LED that is lit (hold the key pressed for 500 msec. at least).

ZEROING As the contacts 3 and 6 are contemporarily closed the column switches in calibration mode, thus by pressing simultaneously the Z-SHIFT and the RUN keys (at least 500msec long) the operator sets the calibration; if the two pushbuttons are released the measurement is automatically zeroset. This happens independently of the programmed calibration mode. Generally, by means of this operation, it is possible to zeroset the column but **not** to correct the sensitivity.

Dynamic measurement:

DIN-ELAB it selects the output of the instantaneous measurement value, if the contact is closed, or of the instantaneous result of the dynamic processing of the measurement, if the contact is open;

RUN if the output of the result of the dynamic processing has been selected, the closing of the contact initializes and enables the dynamic processing; if the processing is not enabled, the value is held;

SEND The closing of the contact commands the transmission of the measurement value to the enabled serial interface; during the transmission and for at least 0.5 seconds the display on the top indicates SEND; if the measurement is held, only one transmission is accepted;

Z_SHIFT selects the zero shift; the zero shift that is active is the one indicated by the LED that is lit. Keep the key pressed for at least 500msec.

ZEROING As the contacts 3 and 6 are contemporarily closed the column switches in calibration mode, thus by pressing simultaneously the Z-SHIFT and the RUN keys (at least 500msec long) the operator sets the calibration; if the two pushbuttons are released the measurement is automatically zeroset. This happens independently of the programmed calibration mode. Generally, by means of this operation, it is possible to zeroset the column but **not** to correct the sensitivity.

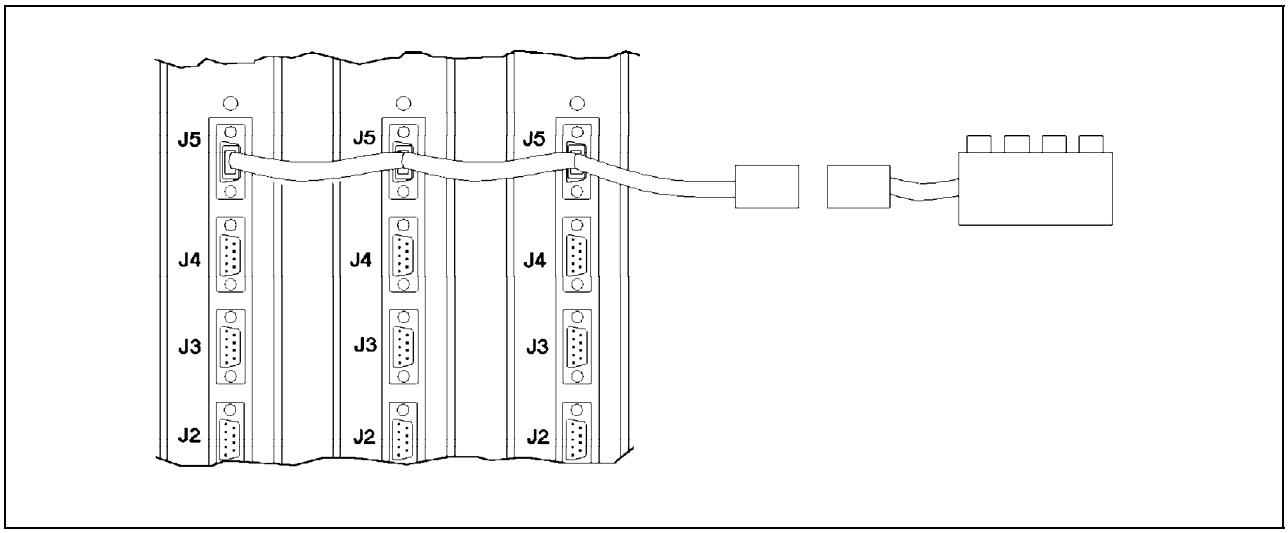
FOOTSWITCH

£ The footswitch (code 6738099015) is another E4N's component. It can be connected either to the a.m. external pushbutton (that is provided with a dedicated connector) or to the J5 connector of the column. The function achieved by the footswitch is the same achieved by the RUN pushbutton.

2.6 Connection of external pushbutton box and/or footswitch to a group of E4N columns

The following cables for connecting different E4N columns to one external pushbutton box or footswitch are available:

£ CABLE FOR CONNECTING two columns to one pushbutton box code 6738097009
£ CABLE FOR CONNECTING three columns to one pushbutton box code 6738097010
£ CABLE FOR CONNECTING four columns to one pushbutton box code 6738097011
£ CABLE FOR CONNECTING five columns to one pushbutton box code 6738097012



£ Figure 13. Example of a connection of three E4N columns to one external pushbutton box by using the cable with
£ code 6738097010

Once connected the columns, it is sufficient to enter just one command for the three columns:

Z-SHIFT
DIN-ELAB/HOLD;
RUN;
Z-SHIFT + RUN (pressed simultaneously)

This is valid for the footswitch too (RUN).
In this cases, that is with cable for multiple connection, it is not possible to use the SEND key, the SEND key has to be used only for the point to point connection, that is connection of a column to a printing unit or to a MITUTOYO or DATAMYTE device.

2.7 Exchange of signals between columns - BUS cable

The E4N column is equipped with input connectors (J1) and output connectors (J2) for transferring the analog signals of the sensors and the signal for the synchronization of the oscillators from a column to £ the others in a composition. The transfer takes place via a common **BUS** formed by connection cables, £ Marposs code 6738057011, which connect the J2 connector of each column to the J1 connector of the £ adjacent column, in all the columns involved in the exchange (Figure 15). If the number of columns is *n*, *n-1* cables will be needed. Figure 14 shows the input J1 connectors and the output J2 connectors for the transfer of the signals between the columns. To the right there are indicated the signals present in the *pins* of these connectors.

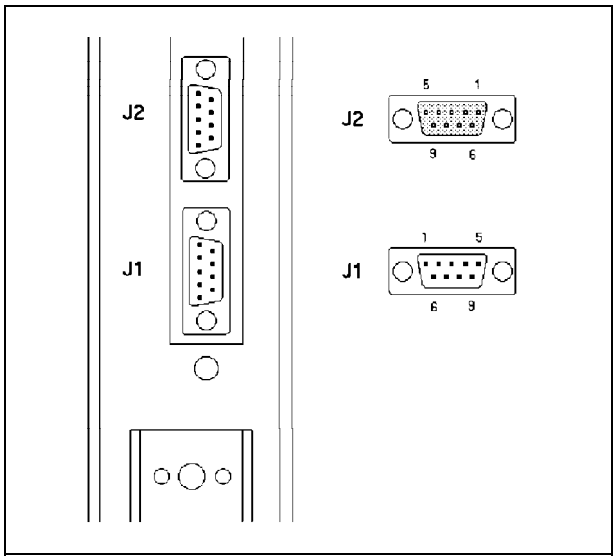


Figure 14. Connectors for transfer of signals

PIN	SIGNAL
1	SHIELD
2	SHIELD
3	SYNCH
4	CH.BUS1
5	CH.BUS2
6	CH.BUS3
7	CH.BUS4
8	NOT CONNECTED
9	SHIELD

The BUS cable always carries out the fundamental function of ensuring that the transducers-supplies of the columns connected to it are **phased**.

The BUS cable can transfer up to four signals. This cable, besides transferring the signals, makes it possible for the transducers-supplies to be phased (or synchronized).
This last function is fundamental to avoid interferences which cause measurement variations.

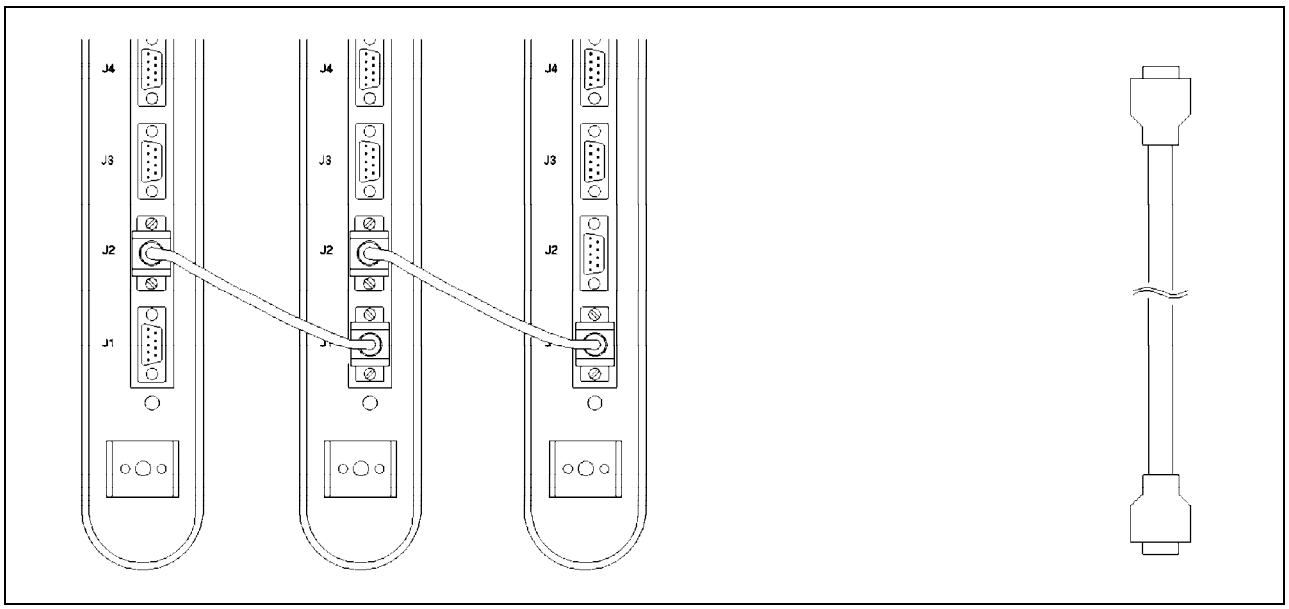


Figure 15. Connection of columns by means of a signal transferring BUS

In some applications made up of different columns, where some columns exchange signals, it is advisable to connect via BUS **all** the columns, also those which are not involved in signals exchange. Via BUS it is possible also to exchange signals between columns which have different sensor types; this means that an E4N column for LVDT and an E4N column for MRT can exchange signals via BUS.

* During the signal exchange phase among columns, a "sender" column and one or more "receiver"
* ones are always present.
* The "sender" column must be Hardware programmed (see paragraph 2.7.1, "Hardware programming of
* signals exchange), while the "receiver" column or columns must have the bus channel/s they need
* completely programmed in PROGRAMMING MODE.

Note! A signal in the transfer BUS can be defined as an output only in one column. The person who makes the connection is charged with verifying the congruence between the allocations that have been made and the programming on the cards of the transducer modules.

2.7.1 Hardware programming of signals exchange

* In a composition of E4N columns, the signals of the sensors of a "sender" column can be transferred to
* the other "receiver" columns through a transferring BUS (see 2.7, "Exchange of signals between columns - BUS cable" on page 20), so as to achieve in a column a combination of signals coming both from its own sensors and from the sensors of other columns (up to 8 signals).

* Each module for the amplification of the sensor signals is equipped with a ***matrix*** that makes the pro-
* gramming of the bus *channel* to which the sensor signal must be assigned possible.

* **Notes:**

* This operation must be performed on each "sender" column.

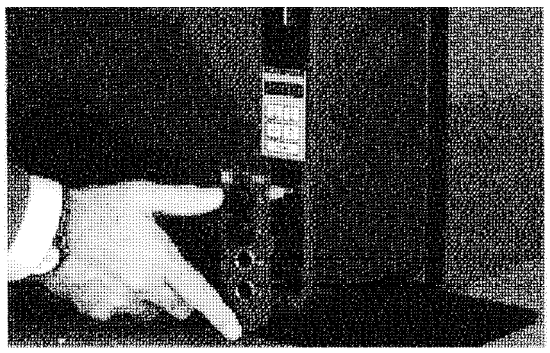


Figure 16. Installation of transducer module

To program the matrix, proceed as follows:

1. unscrew the two screws that fasten the module;
2. extract the transducer module from the column;
3. by means of the jumpers on the module, program the association between the sensor number and the channel number (see Figure 17 on page 22);
4. insert the transducer module into the column;
5. screw the two screws that fasten the module.

The figure below shows the position, on the module card, of the matrix on which it is necessary to act in order to achieve the programming. The programming procedure is described on the right.

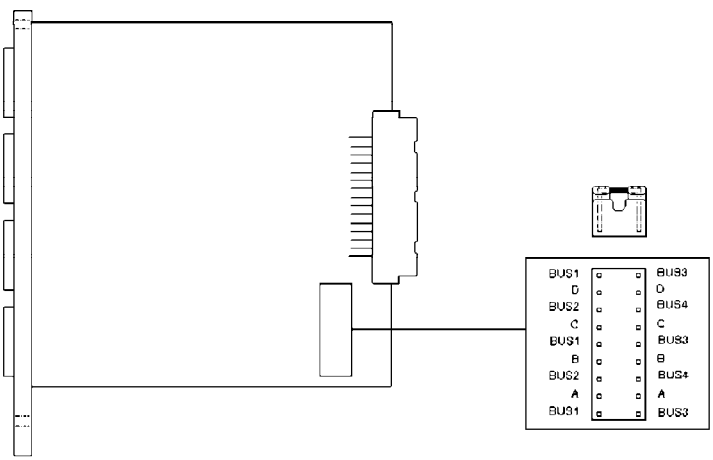


Figure 17. Programming of jumpers on the card of the transducer module

1. on the matrix, find the end of the transducer channel identified by the symbol X (for instance, A for transducer A);
2. on the matrix, find the end of the signal-transferring bus identified by the symbol BUSx (for instance, BUS4 for channel 4);
3. connect the jumper to the pins of the selected ends; this way the signal of sensor X is present in channel BUSx (for instance, A in channel BUS4).

2.7.2 Y-shaped cable to split an input signal

In case the BUS is not sufficient to transfer all the useful signals to the different columns (this is a problem occurring to complex applications), a Y-shaped cable can be used to split an input signal.
By means of such a cable it is possible to transfer a sensor signal to the amplifier modules of two E4N columns.
The amplifier modules of the two columns must be the ones of the same sensor type; the available cables to split the signal are:

£ Y shaped cable to split the signal of an LVDT sensor code 6735932014
£ Y shaped cable to split the signal of an MRT sensor code 6739796001

For HBT and AIR sensors are not foreseen cables to split the signal.

N.B.:

As a sensor signal is transmitted to two different E4N columns, they must be connected with a BUS cable so that the two power supplies are phased.

2.8 Interfaces

The column has three interfaces:

- Digimatic interface;
- RS232 interface;
- analog interface.

A connection to different serial interfaces, such as RS422, RS423, RS485 and Marposs Opelan network, can be made by means of external concentrator adapters.

2.8.1 Digimatic Interface

Figure 18 shows connector J3 for the Digimatic interface. To the right there are indicated the relevant signals present in the *pins* of this connector.

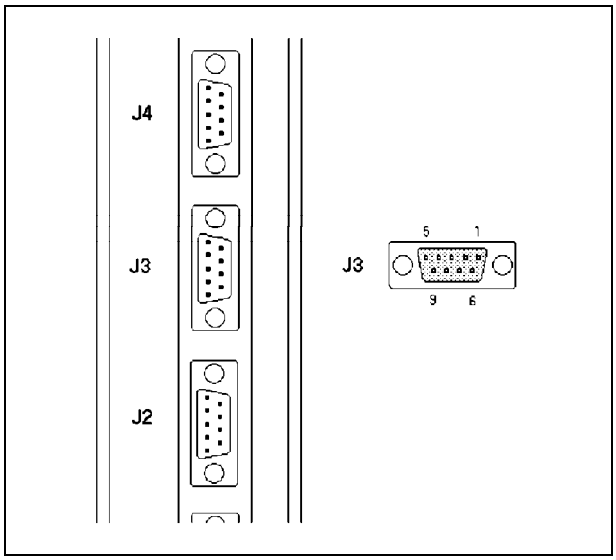


Figure 18. Digimatic interface

PIN	SIGNAL
1	SHIELD
5	DATE
6	CLOCK
7	RDY
8	REQUEST
9	GND
Note: The RDY and REQUEST signals are active when logic level is low.	

The Digimatic interface makes it possible to transfer, in digital mode, the measurement value to statistical analyzers (Mitutoyo, Datamyte, ...) or to concentrators (DataNet, Mitutoyo, ...); in the spare parts list are listed the cable for the point to point connection of the column to some of such devices.

The transfer of the measurement value can be enabled or disabled, and can be carried out both on request of the statistical analyzer and on a command of the operator through the SEND pushbutton.
The transmission of the measurement takes place only when the column is in measuring mode.

The following parameters are supplied:

- measurement value;
- measurement unit (only **mm** or **inches**);
- measurement status (**go** = yellow or green, **ng**$^{+}$ = red^{+}, **ng**$^{-}$ = red^{-}).

* Depending on the programming choice it is possible to exclude the information relevant to the measurement status.

If there are two measurements with autoswitch, the number of the measurements is not indicated.

* It is possible to print the tolerance limits by a Digimatic device connected to the column, details at paragraph 7.10, “Tolerance limits printing with DIGIMATIC device connected to the column” on page 102.

Note:

The DIGIMATIC interface is functioning at the same time as the RS232 output.

2.8.1.1 Example of connection of an external device to a group of E4N columns via DIGIMATIC

EXAMPLE A): CONNECTION OF A DATAMYTE 826 TO A GROUP OF E4N COLUMNS
Via DIGIMATIC, it is possible to connect simultaneously up to three E4N columns to the DATAMYTE 862 (DATA COLLECTOR).
This device is equipped with three inputs, each of which can receive data from an E4N column; the operator requests the measurement data by means of the DATAMYTE (or by means of a pushbutton present on the device or footswitch).

EXAMPLE B): CONNECTION OF A PERSONAL COMPUTER TO A GROUP OF E4N COLUMNS VIA MITUTOYO MULTIPLEXER.
The MUX-10 multiplexer allows to connect up to three E4N columns (VIA DIGIMATIC) to a Personal Computer Via RS232C interface.
The MUX-50 multiplexer allows to transmit to a P.C., with automatic switch, data coming from max. eight E4N columns (VIA DIGIMATIC) via RS232C interface.
In both cases, the operator requests the measurement data by means of MITUTOYO MULTIPLEXER.
The cables necessary to connect the E4N columns to the a.m. multiplexer are the same necessary to connect the column to MITUTOYO DP1-DP2-DP3.

2.8.2 Interface for Analog Output

Figure 19 shows connector J3 for the analog output of the measurement signals. To the right there are indicated the relevant signals present in the *pins* of this connector.

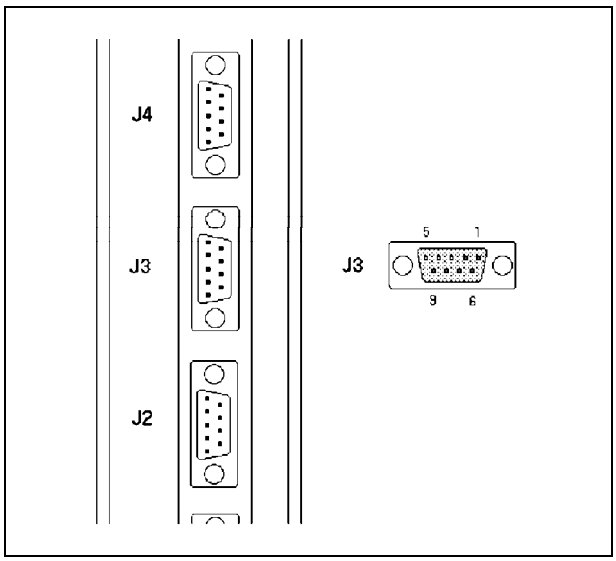


Figure 19. Interface for analog output

PIN	SIGNAL
1	SHIELD
3	ANOUT2.4
4	ANOUT10
9	GND

The analog interface makes it possible to transfer the measurement value to statistical analyzers (Datamyte, ...) or to recorders.
The analog signal is supplied with two full-scale values:

± **2.4 Volt** on pin 3;
±**10 Volt** on pin 4.

The full-scale value of the analog output corresponds to the full-scale value of the LEDs scale on the front panel; the resolution of the analog output is twice the LED scale one.

Example
LED scale resolution = 1 μm
Analog output resolution = 0.5 μm

The following cable to connect the analog interface is available as a component of the E4N system:
£ **Cable for connecting the analog output code 6738098009.**
This cable can be used either for ±2.4Volt or ±10Volt full-scale value. The cable is not equipped with a connector by customer side, it has therefore to be adapted to the current needs.

In case the E4N replaces the E4, use the following cable:
Adapting cable between E4N analog output and cable for E4 analog output code 6738036000.

Note!

This interface shares its connector with the Digimatic interface; if the two outputs must be used at the same time, it is necessary to instal a special T-shaped connector.

2.8.3 RS232 Interface

Figure 20 shows connector J4 of the RS232 interface. To the right there are indicated the signals present on the *pins* of this connector.

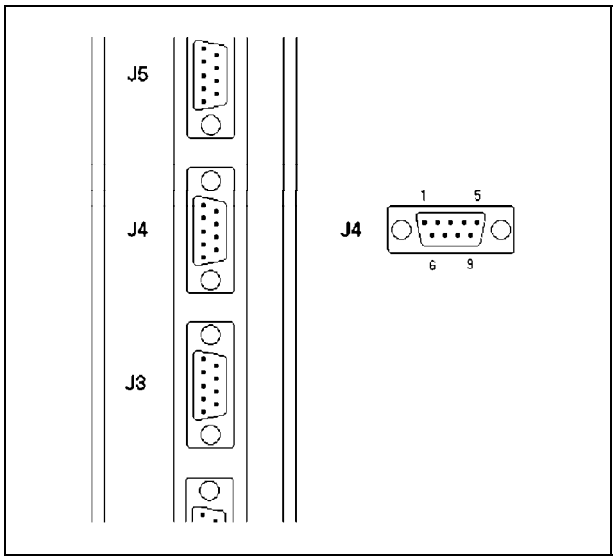


Figure 20. Serial RS232 interface

PIN	SIGNAL
1	NOT CONNECTED
2	RXD
3	TXD
4	DTR
5	SIGNAL GROUND
6	NOT CONNECTED
7	RTS
8	CTS
9	NOT CONNECTED
CASE	SHIELD
Note: compatible with serial PC/AT connector and, by means of a 9-to-25-pole adapter, with PC/XT and PS/2 serial connector.	

The RS232 interface is used for a connection to a serial printing unit or to a host computer.
In the programming phase it is possible to enable one of the two options and to select the standard communication protocol. The serial output RS232 can be used in two different ways:

- PRINT
- HOST

2.8.3.1 PRINT mode

The PRINT mode makes it possible to connect via RS232 the column to printing units or to other external devices, as Personal Computer, to transmit the measurement data.
The "PRINT PROTOCOL" foresees the sending of an 80 characters string, which can be printed in ASCII mode, to an external device. This string is followed by "carriage return" or by "carriage return and line feed" and has the following format:

Characters	Case histories	Description
1 - 8		column identification code
9		space
10 - 17	for one static measurement: for two static measurements: for a dynamic measurement:	space M1 M2 MAX min (M + m)/2 (M-m)/2 M-m
18		space
19 - 26		measurement value
27		space
28 - 35		measurement unit
36		space
37 - 38	measurement status: + LIM < M + PRELIM < M ≤ + LIM - PRELIM ≤ M ≤ + PRELIM - LIM ≤ M < - PRELIM M < - LIM	 "★ +" ">" "@" "<" "★ -"
39 - 42	If the measurement is not classified: If the measurement is classified: where nn = class number	space nn
43		"("
44 - 51		Upper Tolerance Limit
52		","
53 - 60		Lower Tolerance Limit
61		")"
62 - 80	If ZERO SHIFTS faults: In case of ZERO SHIFTS: **where:** n = zero shift number xxxxxxxx = zero shift value	space "SHIFT n = xxxxxxxx"

The string transmission can be requested by:

1. pressing the SEND key of the external pushbutton box connected to the J5 connector of the column
2. sending of a **capital** M character on the serial line of the E4N column.

Note: In the paragraph 4.5.8, "'COMM:' menu" on page 63 is shown an example of transmission of the measurement data from E4N to PC, requested by the keyboard of the PC.

To connect the E4N to external devices, to transmit the measurement data, use the RS232 output corresponding to the J4 connector (see Figure 20 on page 27); this output is defined as **Host serial port**.

For this purpose the following cable are available:

RS232 CONNECTING CABLE (9 to 25 pins)	code 6737916000
RS232 CONNECTING CABLE (9 to 9 pins)	code 6737957002

2.8.3.2 HOST mode

The HOST mode makes it possible to connect, VIA RS232, the column to a Personal Computer and achieve the following functions:

- programming of the column by means of remote keyboard and data storing;
- transfer of the programming data from the column to the P.C. or viceversa (UP/DOWN LOADING);
- measurement data collection.

The P.C. must be equipped with the E4N PC LINK software.

Here following a list of all the extension cables necessary to connect the Personal Computer to the E4N.
The E4N column may foresee two RS232 serial ports for the connection to Personal Computer:

HOST serial port: it is always present on the rear panel of the E4N and is identified by the J4 connector.

REMOTE serial port: it is located on the front panel of the E4N whereas the column foresees the remote programming module.

Extension cables list

A) Between Personal Computer and E4N:

extension cable between IBM/AT or a compatible one and Host serial port of the E4N (J4 connector on the back panel)	code 6737957002
extension cable between IBM/PS-2 or a compatible one and Host serial port of the E4N (J4 connector on the back panel)	code 6737916000
extension cable between IBM/AT or a compatible one and remote serial port of the E4N (connector on the front panel)	code 6735957000
extension cable between IBM/PS-2 or a compatible one and remote serial port of the E4N (connector on the front panel)	code 6735916000

B) To serial connect different E4N to a Personal Computer:

This extension cable is necessary to connect several E4N gauges of a local measuring station to a Personal Computer.
The extension cable consists in as many female connectors as the columns to serial connect are. More over, there is a male connector to be connected to the extension cable between Personal Computer and E4N.
The female connectors of this extension cable must be inserted into the Host serial port of each column.

£ extension cable to connect up to 5 E4N: code 6739797027

£ extension cable to connect up to 4 E4N: code 6739797028
£ extension cable to connect up to 3 E4N: code 6739797029
£ extension cable to connect up to 2 E4N: code 6739797030

Note

The extension cable between PC and E4N must be that for the connection with the J4 rear serial port (Host) of the E4N. To serial connect different E4N columns it is not possible to use the remote serial port.

Note!

If the column is not equipped with a local programmer, when the remote programmer is connected to the column it is not possible to use the RS232 interface, which is engaged in the communication with the remote programmer.

2.9 RELAY-BCD output

The relay card with code 6344360100 is available for the E4N column.
The functioning is based on the outputs of 8 relays.

According to the programming, the card can be used alternatively either for sorting into classes or for
* identification of the measurement status of the checked parts; in case of dynamic elaboration it will be
* possible to obtain such information only at the end of the cycle (that is when the run key of the
* external pushbutton box has been released).

Note:

In the relay-BCD card it is foreseen a relay for the "DATA VALID", that is the pin 1 = STROBE.
During datum transmission, in particular when it is changing (that is the measurement is changing), there is a time period during which the relays are zeroed and then returns to 1. In this time period the measurement is not valid and the STROBE is open.
The external device must acquire data with the STROBE closed.

2.9.1 RELAY-BCD output for the identification of the measurement status

The Figure 21 shows the J6 connector of the relay output. If the column has the relay card and the classes number is reset in programming mode (see paragraph 4.5.5, "'CLASS :' Menu" on page 57), that is CLASSES No=R_, the pins of the J6 connector receive the signals listed in the table of Figure 21.

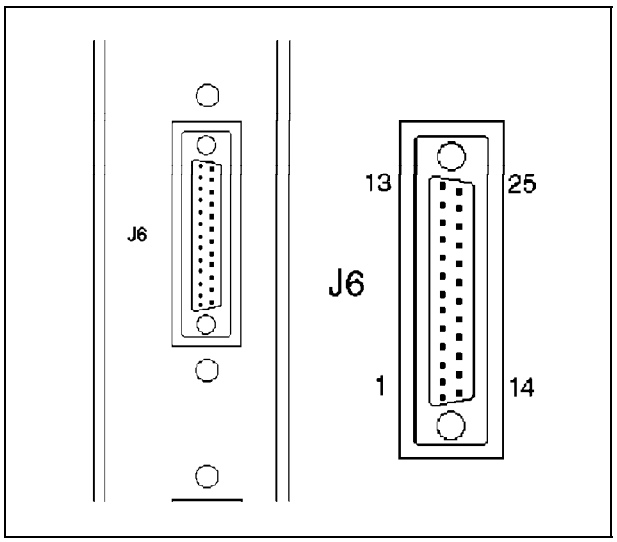


Figure 21. Interface for relay output

Pin	Status	Signal		Pin	Signal
1	1	Strobe		12	Rel.common
2	1	Measure 1		13	Ground
2	0	Measure 2		18	Rel.common
3	1	Scrap		19	Rel.common
4	1	Pre scrap -		20	Rel.common
5	1	OK		21	Rel.common
6	1	Pre scrap +		22	Rel.common
7	1	Scrap +		23	Rel.common
8	1	Invalid meas.		24	Rel.common
				25	Rel.common

Note:

Status = 1 → relay contact closed
Status = 0 → relay contact open

2.9.2 RELAY-BCD output for sorting into classes

The Figure 22 on page 32 shows the J6 connector of the relay output.
If the column has the relay card and the classes are programmed in programming mode (see paragraph 4.5.5, "'CLASS :' Menu" on page 57), that is CLASSES No>O, the pins of the J6 connector receive the signals listed in the table of Figure 22 on page 32.

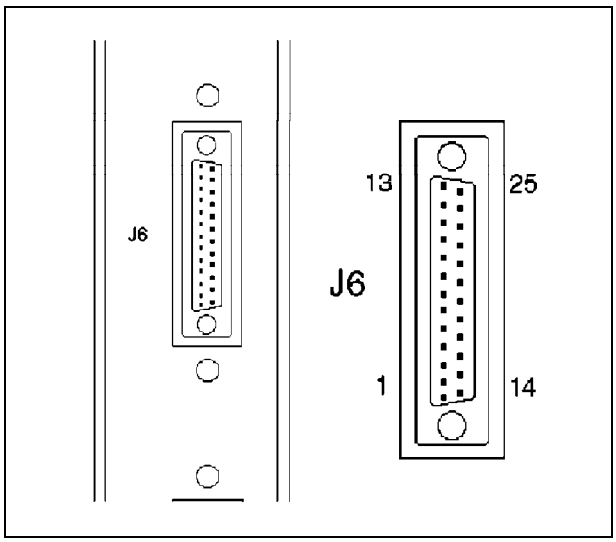


Figure 22. BCD interface for sorting into classes

Pin	Status	Signal			Pin	Signal
1	1	Strobe			12	Rel.common
2	1	Measure 1			13	Ground
2	0	Measure 2			18	Rel.common
3	1/10	See next table			19	Rel.common
4	1/10	See next table			20	Rel.common
5	1/10	See next table			21	Rel.common
6	1/0	See next table			22	Rel.common
7	1/0	See next table			23	Rel.common
8	1/0	See next table			24	Rel.common
					25	Rel.common

Note:

Status = 1 → relay contact closed
Status = 0 → relay contact open

	PIN						SIGNAL			PIN						SIGNAL
	8	7	6	5	4	3				8	7	6	5	4	3	
*	0	0	0	0	0	0	Scrap -			0	1	0	1	1	0	Class 16
*	0	0	0	0	0	1	Class 1			0	1	0	1	1	1	Class 17
*	0	0	0	0	1	0	Class 2			0	1	1	0	0	0	Class 18
*	0	0	0	0	1	1	Class 3			0	1	1	0	0	1	Class 19
*	0	0	0	1	0	0	Class 4			1	0	0	0	0	0	Class 20
*	0	0	0	1	0	1	Class 5			1	0	0	0	0	1	Class 21
*	0	0	0	1	1	0	Class 6			1	0	0	0	1	0	Class 22
*	0	0	0	1	1	1	Class 7			1	0	0	0	1	1	Class 23
*	0	0	1	0	0	0	Class 8			1	0	0	1	0	0	Class 24
*	0	0	1	0	0	1	Class 9			1	0	0	1	0	1	Class 25
*	0	1	0	0	0	0	Class 10			1	0	0	1	1	0	Class 26
*	0	1	0	0	0	1	Class 11			1	0	0	1	1	1	Scrap +
*	0	1	0	0	1	0	Class 12			1	0	1	0	0	0	Not used
*	0	1	0	0	1	1	Class 13			1	0	1	0	0	1	Not used
*	0	1	0	1	0	0	Class 14			1	1	0	0	0	0	Invalid measurement
*	0	1	0	1	0	1	Class 15			1	1	0	0	0	1	Measurement not performed

2.10 Connection to the MARPOSS OPELAN network

The column can be connected to the Marposs Opelan network by means of an external interface:

- MARPOSS E68 A/D

The connection consists of bringing the signal collected at the analog output of the E4N to the analog/digital converter MARPOSS E68 A/D.

To perform this connection the following cables are available:

Connecting cable for one E4N to one E68 A/D code 6738039000

Connecting cable for two E4N to one E68 A/D code 6739739017
The two a.m. cables make it possible to connect one or two columns directly to the E68 A/D.

Connecting cable for one E4N
to a junction box for E68 A/D code 6738049000
The a.m. cable connects one column to the junction box for E68 A/D; two versions of box are available, one for up to 8 inputs and one for up to 16 inputs.

Chapter 3. Operating Modes of E4N Column

The column has the following operating modes:

- **Measurement mode:** it is the mode to which the column passes when it is switched on; in this mode the operator can perform and display the measurement. From the measurement mode it is possible to pass to the other modes.
- **Calibration mode**: this mode makes it possible to zero-set the measurement by means of a mechanical master workpiece.
- **Adjustment mode**: in this mode the column displays the measurement values read by the sensors connected to it, in order to make it possible to adjust their mechanical positioning, or in case of AIR/ELECTRONIC sensor to perform the initial adjusting.
* - **Programming mode**: when the column is in this mode, it is possible to program its functions. The
* programming mode is formed by the following groups of functions:

* **PROG L1** programming of a part of the data;
* **PROG ALL** programming of all the data.

* The menus of PROG L1 are a subset of those of PROG ALL.

Each operating mode will be described in a separate chapter.

Chapter 4. Programming of E4N Column

4.1 Programming Guide

* In order to easily program the E4N column, in appendix B of this manual two flow charts are supplied:

* **A.** Flow chart for complete programming (PROG ALL)

* **B.** Flow chart for abridged programming (PROG L1)

* By using these flow charts you have a global view of the programming structure. Furthermore you can
* obtain, for programming main menues, the references to the manual pages where more detailed
* descriptions about the data to program are reported.

* The above mentioned flow charts are basic instruments to the programming of E4N column with "local
* programming module".

* This chapter begins with a general introduction which explains the objects of the programming and the
* procedures for acting on the menus and editing the data.
* At the end, there is an example of a programming operation.

In the case of E4N column with module for remote programming, consult the instruction manual of E4N P.C. LINK.
E4N P.C.LINK is a software package used as a guide for the column programming through P.C..

4.2 To begin Programming

The column with a local programming module is equipped also with an alphanumerical display.
If the column has never been programmed, when it is switched on the alphanumerical display shows the message **N READY:**, and the upper 7-segment display shows the message **n.r.**.

Below there is indicated the sequence of actions that are necessary to enter the **PROGALL :** menu for the complete programming of the column.

ACTION	OPERATOR	DISPLAY
Start programming	press PROG for 2 seconds	N READY: after 2 seconds the column displays PROG
	release PROG	PROG L1:
Move to option **PROGALL:**	press ⇨	PROGALL:
Confirm choice	press ENTER	GENERAL:

4.3 General Rules for Editing

During the programming, the display of the programming module of the column shows some **SEQUENCES OF CHARACTERS**.
They may have three different meanings:

NAMES OF MENUS a menu name is identified by the fact that it ends with the character ':';

- for instance, the name **GENERAL:**, since it ends with the character ':', indicates the **GENERAL** menu.

NAMES OF VARIABLES the name of a variable is identified by the fact that it ends with the character '=';

- for instance, the name **M.SYST =**, since it ends with the character '=', indicates the **M.SYST** variable.

DATA a datum must be associated to each variable by defining the value that the variable must assume.

The **DATA** are the only sequences of characters that can be ***edited***.
There are three types of data that can be edited:

Predefined a predefined datum is formed by a limited group of predefined sequences of characters;

Numerical a numerical datum is formed by a sequence (that can be edited) of digits expressing a numerical value, with or without sign, in a predefined measurement unit;

String a string-type datum is formed by a sequence (that can be edited) of alphanumerical characters belonging to the ASCII alphabet; its length is predefined.

4.4 Use of Keys

The programming module has 5 keys and an alphanumerical display.
The result of the pressing of the keys depends on the option that is being shown by the display at that moment, so it is necessary to distinguish between a situation in which the display is showing a menu or submenu, a variable or a datum that can be edited.
In the first two cases, the keys are used to move within the menus or submenus and among the variables; in the third case, they are used to edit the data.
The next two paragraphs explain how to move within the menus and how to edit the data.

* 4.4.1 Moving within the Menus and the variables

- If the display is showing a **menu** or a **submenu**, the keys achieve the following actions

KEY	ACHIEVED ACTION
* * PROG/UP	the next higher-level menu is displayed, or, if there is no higher-level menu, the programming mode is quitted;
CAL/LEFT	in a sequence of submenus belonging to the same menu, the previous submenu, if it exists, is displayed;
RIGHT	in a sequence of submenus belonging to the same menu, the subsequent submenu, if it exists, is displayed;
ENTER	the lower-level menu, or the first variable belonging to it, is displayed.

- If the display is showing a **variable**, the keys achieve the following actions:

KEY	ACHIEVED ACTION
* PROG/UP	the next upper-level menu is displayed;
CAL/LEFT	in a sequence of variables belonging to the same menu, the previous variable is displayed; if the current variable is the first one in the sequence, the last one is displayed;
RIGHT	in a sequence of variables belonging to the same menu, the next variable is displayed; if the current variable is the last one in the sequence, the first one is displayed;
* ENTER	the programming of the variable is activated and a datum is displayed .

- If the display is showing a **datum that can be edited**, the action achieved by the keys depends on the type of datum. The editing of the data will be described in the next paragraph.

4.4.2 Editing the Data

In the programming stage, the column indicates that a datum can be edited by causing the displayed characters to blink.

- **Editing of a predefined datum**

  The editing consists in the selection of a *predefined* sequence of characters. Throughout the editing, the entire sequence of characters blinks.

  For the selection of the characters, only the following keys are active:

KEY	ACHIEVED ACTION
PROG/UP	selects the previous sequence of characters; if the current sequence is the first one, the last sequence is selected.
DOWN	selects the subsequent sequence of characters; if the current sequence is the last one, the first sequence is selected.
ENTER	confirms the edited datum and causes a transition to the next variable.

Programming procedure:

1. select the predefined sequence of characters by acting on keys PROG/UP and DOWN;
2. press ENTER to confirm the selection that has been made.

- **Editing of a string-type datum**

  The editing of a string consists in entering a sequence of characters with a predefined length. During the selection, only the character to be edited blinks.

  For the selection, the following keys are active:

KEY	ACHIEVED ACTION
CAL/LEFT	selects the character to the left of the current one
RIGHT	selects the character to the right of the current one; if the blinking character is the last one on the right, the use of this key causes the displayed part of the string to move to the left by one character;
PROG/UP	selects the next character: if the current character is the last one, the first character is selected;
DOWN	selects the previous character: if the current character is the first one, the last character is selected.
ENTER	confirms the edited datum and causes a transition to the next variable.

Programming procedure:

1. select the desired character by acting on keys PROG/UP and DOWN;
2. press RIGHT to move to the next character;
3. repeat steps 1 and 2 for all the characters of the string;
4. press ENTER to confirm the choice that has been made.

- **Editing of a numerical datum**

The editing of a numerical datum consists in the selection of a sequence of digits, with or without sign, and if necessary with a decimal point; the ranges to the left and to the right of the decimal point are fixed.
Throughout the selection stage, only the digit that is being edited blinks.

For the selection, the following keys are active:

KEY	ACHIEVED ACTION
CAL/LEFT	selects the digit to the left of the current one; if the current digit is the last one, the first digit is selected;
RIGHT	selects the digit to the right of the current one; if the current digit is the first one, the last digit is selected;
PROG/UP	selects the next digit, increasing its weight; the digit that follows 9 is 0;
DOWN	selects the previous digit, decreasing its weight; the digit that precedes 0 is 9;
ENTER	confirms the edited datum and causes a transition to the next variable, if it exists.

Programming procedure:

1. if the numerical datum is preceded by the sign, use the PROG/UP and DOWN keys to select the sign; otherwise use the PROG/UP and DOWN keys to select the desired digit;
2. press RIGHT to select the next digit;
3. select the desired digit by means of the PROG/UP and DOWN keys;
4. repeat steps 2 and 3 for all the digits of the numerical datum;
5. confirm the choice that has been made, by pressing ENTER.

Notes:

- When ENTER is pressed, the column checks the datum to be programmed. If the datum is all right, it is accepted; otherwise the column refuses the programming of the datum and displays this situation by blinking in a different way from the usual one: the digit that can be edited does not blink, and all the other ones blink.
- A numerical datum can be defined 'not programmed' by acting on the most significant digit of the numerical datum or on the sign, if present, by repeatedly pressing the UP or DOWN pushbutton until the display shows the symbol R-.---.

4.5 Main menus

4.5.1 'GENERAL :' Menu

The figure below shows the variables of the **GENERAL :** menu, the data that can be associated to it and the keys that must be pressed to pass from one variable to another.

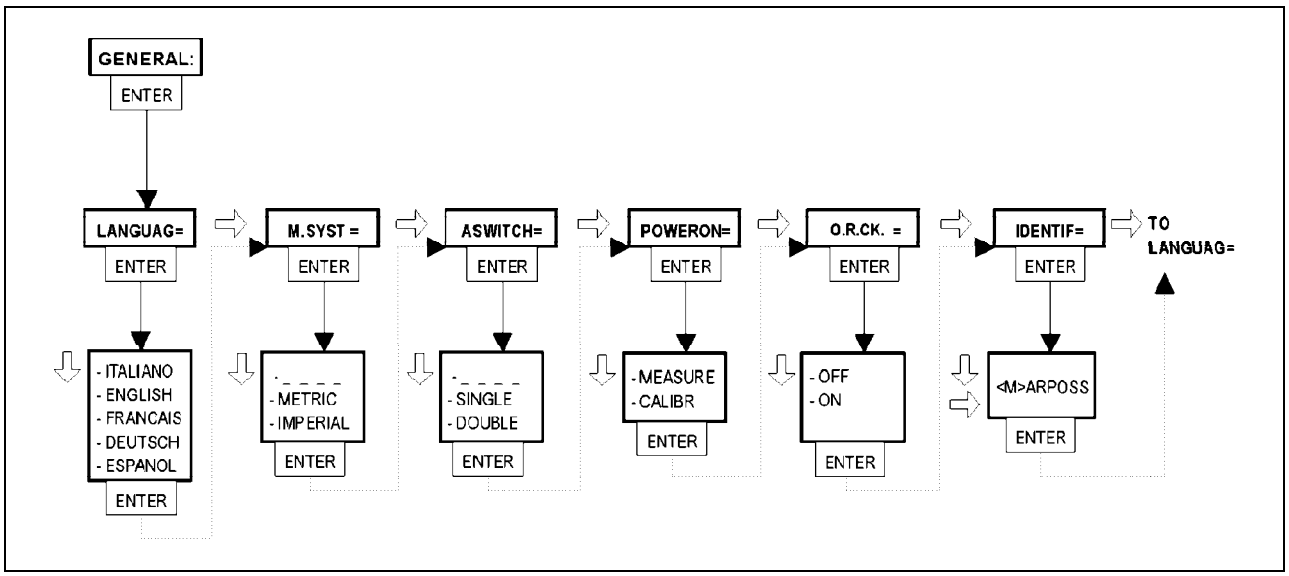


Figure 23. 'GENERAL :' menu

The variables of the menu have the following meanings:

LANGUAGE= national language to be used during programming and use;

type of datum: predefined: only one of the following options can be chosen:

- ITALIANO
- ENGLISH
- FRANCAIS
- DEUTSCH
- ESPANOL

The **LANGUAGE=** *becomes active as soon as it is programmed: so starting from that instant, the options of the menus and of the variables will be expressed in the language that has been chosen.*

M.SYST = measurement system used for the representation of physical quantities;

type of datum: predefined: only one of the following options can be chosen:

- -------- ; value to be replaced with one of the following
- METRIC
- IMPERIAL

The **M.SYST =** *variable becomes active as soon as it is programmed; so, starting from that moment, the options of the data of the variables relevant to the measurement system will be those of the measurement system that has been chosen.*

ASWITCH= number of measurements performed by the column;

type of datum: predefined; only one of the following options can be chosen:

--------	value to be replaced with one of the following;
SINGLE	the column carries out only one measurement;
DOUBLE	the column carries out two measurements.

The column can carry out two measurement if the following conditions exist:

- *the two measurements do not require any dynamic processing;*
- *the two measurements are performed by means of the signals of different sensors;*
- *the number of signals involved in the two measurements is equal to, or less than, four.*

If the variable is programmed as *DOUBLE*, the column presents the variable M1 ; M2=, *after the* CHANNEL: *menu: this variable makes it possible to select measurement 1 or measurement 2 in order to proceed with the relevant programming. In case of reprogramming the column and passing from two to just one measure, with the* ASWITCH= *put at* SINGLE, *it is automatically obtained a programming for just one measurement, that is for the measurement 1 already resident. Data relevant to measurement 2, previously programmed, will be excluded.*

* Figure 24 on page 44 shows the procedure that is recommended to program two measurements, so as
* to avoid the error messages that the column gives when there are some unprogrammed parameters.

1. Press ENTER while the display shows the 'M1 ; M2 =' variable.
2. Select the predefined MEASURE1 datum, in order to inform the column that measurement 1 must be programmed.
3. Program the variables of the following menus in the stated order:
   a. **'MEASURE :'**;
   b. **'TOLER :'**;
   c. **'CLASS :'**;
   d. program the **'SCALE ='** variable;
   e. **'DISPLAY :'**;
   f. **'MASTER :'**.
4. Repeatedly press the RIGHT key in order to return to the 'M1 ; M2 =' variable; press ENTER when the display shows the 'M1 ; M2 =' variable.
5. Select predefined datum MEASURE2, in order to inform the column that measurement 2 must be programmed.
6. Program the variables of the following menus in the stated order:
   a. **'MEASURE :'**;
   b. **'TOLER :'**;
   c. **'CLASS :'**;
   d. program the **'SCALE ='** variable;
   e. **'DISPLAY :'**;
   f. **'MASTER :'**.
7. The procedure ends with the request to check the programming that has been done. To make this request, press ENTER when the display is showing CHECK.
   If the programming is all right, the column displays the 'M1 ; M2 =' variable; otherwise it gives some message errors: consult the relevant chapter.
8. Press ENTER when the display shows the 'M1 ; M2 =' variable.
9. Select predefined datum MEASURE1, in order to inform the column that the menus relevant to measurement 2 must be quitted.
10. Repeatedly press the RIGHT key in order to find the 'COMM :' menu, with which Step 3 of the programming begins.

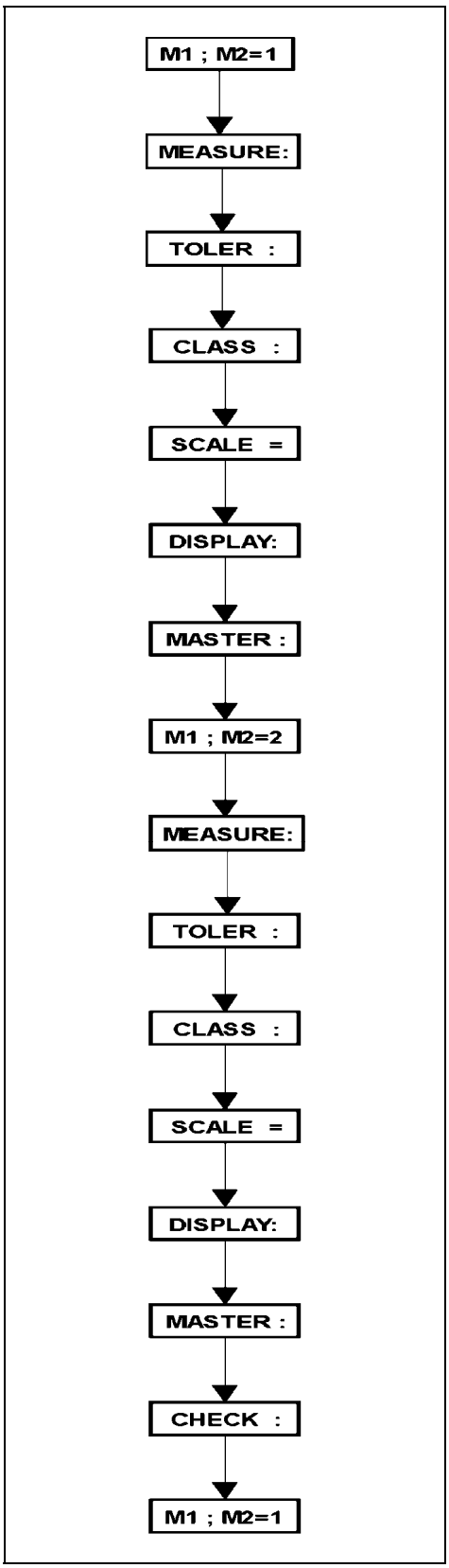


Figure 24. Programming of two measurements

POWERON = operating mode in which the column is put at power on;

type of datum; predefined: only one of the following options can be chosen:

- MEASURE
- CALIBR

If the **POWERON** *= variable is on*

MEASURE *at power-on the column is put into the* **MEASUREMENT MODE***;*
CALIBR *at power-on the column is put into the* **CALIBRATION MODE***, in order to remind the operator that it is necessary to perform a calibration before measuring; if at power-off the column was calibrated, the operator may start measuring without performing the calibration, by pressing CAL.*

£ **O.R.CK.=** When enabled on columns linked to two or more sensors, this function checks that the
£ sensors are actually overrange when the column itself is OVERRANGE.
£ If only one of the sensors is in range and all the other sensors are overrange, the
£ column will display the message "p.o.r." (partial overrange).

£ **type of datum:** predefined; only one of the following options can be choosen:

£ **OFF** the check is not performed

£ **ON** the check is enabled.

IDENTIF = identification of column;

type of datum: string.

4.5.2 'CHANNEL :' Menu

The figure below shows the submenus that belong to the **CHANNEL :** menu and the keys that must be pressed to pass from an option to another.

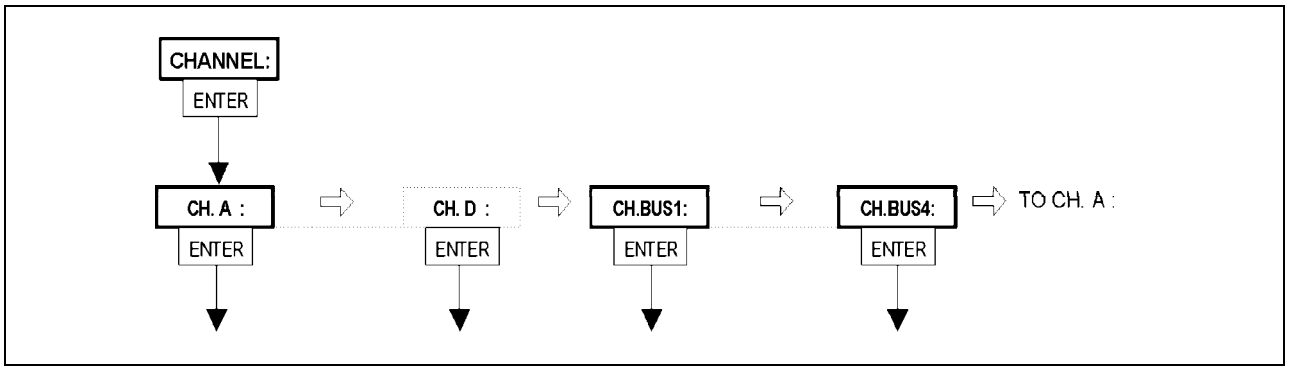


Figure 25. 'CHANNEL :' menu

Submenus

- **CH.A:**, **CH.B:**, **CH.C:** and **CH.D:** correspond, in the same order, to physical channels **A**, **B**, **C** and **D** of the *'transducer module'*;
- **CH.BUS1:**, **CH.BUS2:**, **CH.BUS3:** and **CH.BUS4:** correspond, in the same order, to the channels of the external bus for the exchange of signals between the columns, present on the pins of connectors J1 and J2, on the back of the column.

During the signal exchange phase among columns, a SENDER column and one or more RECEIVER ones are always present. In PROGRAMMING mode the RECEIVER columns BUS channels have to be completely programmed (that is customized) since the signals they receive have no SENDER column programming parameter. The figure below shows the variables that belong to the menus of a channel and the keys that must be pressed in order to move among the variables and their data. The UP key is used to display the menu subsequent to the one that has been programmed.

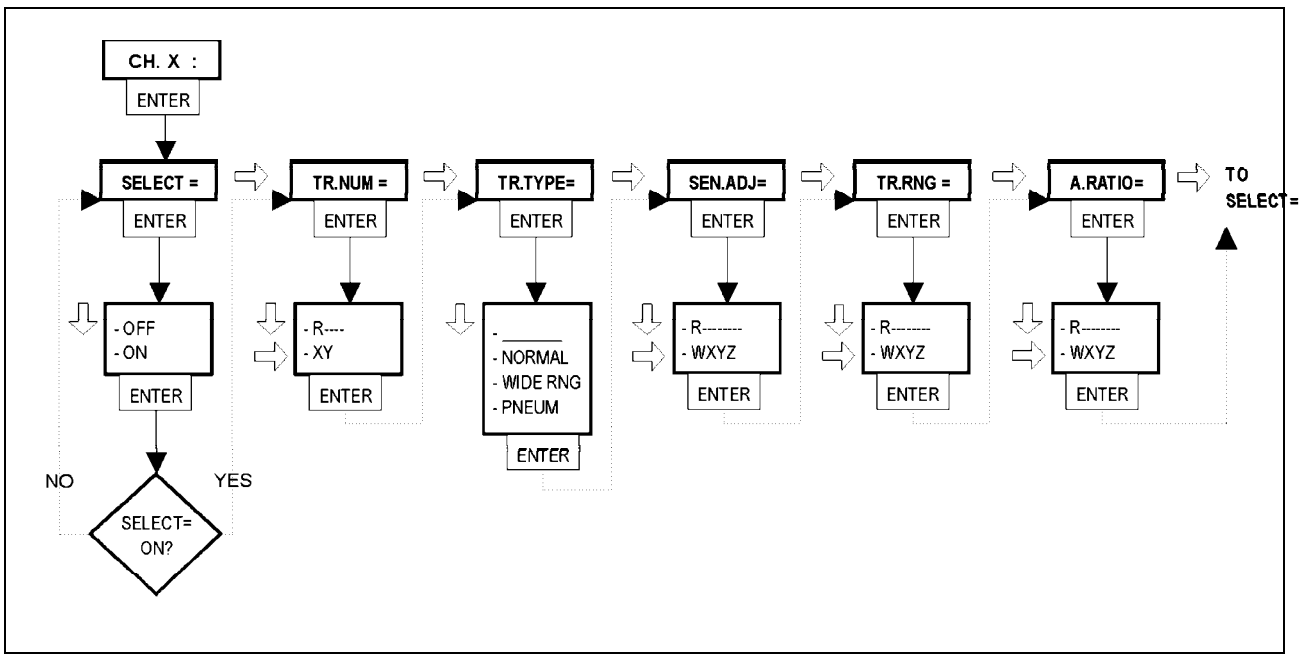


Figure 26. Menu of a channel

The variables of the menu have the following meanings:

SELECT = indication of the channel that is being used;

type of datum: predefined: only one of two options can be chosen:

- ON
- OFF

Note

If for the **SELECT** *= variable* **OFF** *is chosen, the options of the remaining variables of the menu of that channel are not displayed.*

TR.NUM = number of transducer: copy the indication on the plate of the connector of the transducer;

type of datum: numerical with two digits: only one of the following options can be chosen:

- R - ; not programmed;
- from 00 to 99.

TR.TYPE = type of transducer, normal, wide-range or pneumatic;

type of datum: predefined; only one of the following options can be chosen:

- -------- ; value to be replaced with one of the following;
- NORMAL: up to $\pm$1000 μm ($\pm$40 inches/1000);
- WIDE RNG: up to $\pm$5000 μm ($\pm$200 inches/1000).
- PNEUM: up to $\pm$100 μm ($\pm$4 inches/1000)

SEN.ADJ = coefficient for correction of sensitivity that makes it possible to bring the actual sensitivity of the transducer to the nominal sensitivity.
The range of action is $\pm$5% for normal or wide range transducer; and $\pm$25% for pneumatic transducer.

type of datum: numerical; only one of the following options can be chosen:

- R.--- ; not programmed; the default value is SEN.ADJ = 1;
- from 0.950 to 1.050 for normal and wide range transducer, with resolution 0.001. No value exceeding the admitted range is accepted.
- from 0.750 to 1.250 for pneumatic transducer, with resolution 0.001. No value exceeding the admitted range is accepted.

TR.RNG = semi-range of the sensor: it must be the half (or smaller than the half) of the range declared for the sensor that is being used; by programming a smaller range the accuracy of the measurement can be improved;

type of datum: numerical: only one of the following options can be chosen:

- R--- ; value to be replaced with one of the following;
- 0000 to 1000 μm (000 to 40 inches/1000) if TR.TYPE = NORMAL;
- 0000 to 5000 μm (000 to 200 inches/1000) if TR.TYPE = WIDE RNG.
- 0000 to 100 μm (000 to 4 inches/1000) if TR.TYPE = PNEUM

Example of TR RANGE= programming:
Diameter measurement with two pencil probes, the two pencil probes have a working range of = $\pm$1000 μm;
the diameter to be measured has a tolerance of $\pm$50 μm respect to the nominal value;

in this case it is sufficient to program for each channel a TR RNG = 100; it means that to satisfy this application it is necessary to foresee for the pencil probes a working range of ±100 μm.

Note

A channel is in **OVERRANGE** *if the signal is out of the programmed range.*

A.RATIO = Arm ratio defined as a ratio between the displacement at the workpiece and the displacement of the sensor; it is a parameter that makes it possible to allow for a mechanical transmission with unequal arms placed between the workpiece and the sensor;

type of datum: numerical: only one of the following options can be chosen:

- R.--- ; it has to be replaced with a numerical value;
- from 0.500 to 3.000, with a resolution of 0.001.

Note

In case of **TYPE = PNEUM** the value of the arm ratio is equal to 1 and is not changeable.

4.5.3 'MEASURE :' Menu

* Because of the big dimensions of menu 'MEASURE' the figure below shows a part of the varibles rele-
* vant to such menu, the data that can be associated to them and the keys that must be pressed in order
* to select the options. The other variables will be described later on.

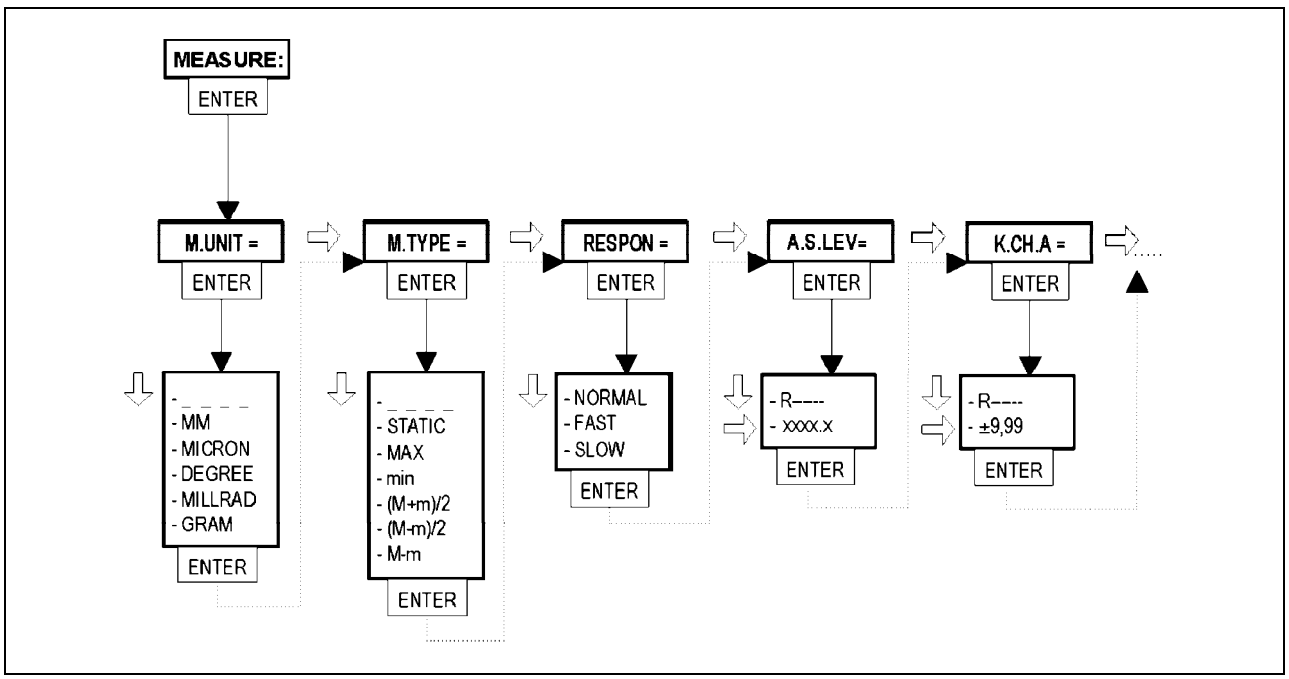


Figure 27. 'MEASURE :' menu

The variables of this menu have the following meanings:

M.UNIT = measurement unit:

type of datum: predefined; depending on the measurement system that is used, only one of the following values can be selected:

METRIC	Format	Resolution		IMPERIAL	Format	Resolution
———	value to be replaced with one of the following			———	value to be replaced with one of the following	
MM	±x.xxxx	0.0001		INCHES	±.xxxxxx	0.000005
MICRONS	±xxxx.x	0.1		THOU-SANDS	±xxx.xxx	0.005
DEGREES	±x.xxxx	0.0001		MILLIONS	±xxxxxx	5
MILLRADS	±xxx.xxx	0.002		DEGREES	±x.xxxx	0.0001
GRAMS	±xxxx.x	0.1		MILLRADS	±xxx.xxx	0.002
				GRAMS	±xxxx.x	0.1

Note: *The* **M.UNIT =** *variable becomes active as soon as it has been programmed; so starting from that moment the position of the decimal point on the display is defined automatically.*

M.TYPE = type of measurement performed by the column;

type of datum: predefined; only one of the following options can be chosen:

-------- ; value to be replaced with one of the following;

STATIC the column displays the result of the static measurement;

MAX the column displays the maximum value of the dynamic measurement;

min the column displays the minimum value of the dynamic measurement;

(M + m) / 2 the column displays the sum of the maximum value and of the minimum value of the dynamic measurement divided by 2;

(M - m) / 2 the column displays the difference between the maximum value and the minimum value of the dynamic measurement divided by 2;

(M - m) the column displays the difference between the maximum value and the minimum value of the dynamic measurement;

Note: *The* **M.TYPE =** *variable can be associated only to the* **STATIC** *option if the column is performing two measurements, that is to say if* **A.SWITCH = DOUBLE** *has been programmed.*

RESPON = speed of response of filter that is led scale response speed.

type of datum: predefined; only one of the following options can be chosen:

NORMAL
FAST
SLOW

£ **A.S.LEV =** bilateral threshold that determines the working range within which the measurement
£ is regarded as valid and can be displayed; outside of this range, the scale must be off.

£ **type of datum:** numerical without sign; only one of the following options can be
£ chosen:

£ • R---.- ; not programmed;

£ • xxxx.x ; numerical value whose format depends on the value that
£ has been programmed for variables **M.UNIT =** and **RESOLUT =**;

£ **Notes:**

£ 1. *The* **A.S.LEV =** *variable is visible if the column is performing two measure-*
£ *ments, that is to say if* **A.SWITCH = DOUBLE** *has been programmed.*

£ 2. *Since only one readout scale is available, the column can display only one*
£ *measurement at a time. It uses the values assigned to the A.S.LEV = vari-*
£ *ables, together with the fact that the measuring sensors are not in over-*
£ *range, to decide which of the two measurements must be displayed.*
£ *The following rules are followed by the display:*

£ a. *if none of the two measurements can be displayed, the message* **o.r.** *is*
£ *shown on the upper display;*

£ b. *if only one measurement can be displayed, it is displayed;*

£ c. *if both the measurements can be displayed, the* **o.r.** *message on the*
£ *upper display is shown.*

The figure below shows the variables that are associated to the coefficients of the measuring formula, the data that can be associated to them, and the keys that must be pressed in order to select the options.

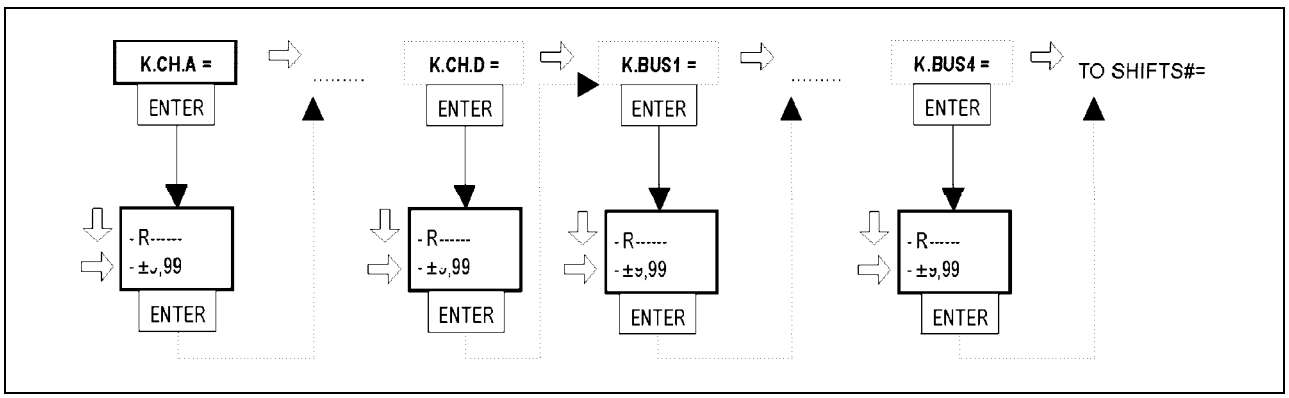


Figure 28. 'MEASURE:' menu

The variables **'K.CH.A ='**, **'K.CH.B ='**, **'K.CH.C ='**, **'K.CH.D ='**, **'K.BUS1 ='**, **'K.BUS2 ='**, **'K.BUS3 ='** and **'K.BUS4 ='** have the meaning of a multiplication coefficient for the signal of the channel.

type of datum: numerical with sign; only one of the following options can be chosen:
- R-.--- ; not programmed;
- numerical value within the interval ±9.999, with resolution 0.001.

Notes:

1. *The column displays only the variables of the coefficients relevant to the channels for which the* **SELECT** = *variable has been put at* **ON**.
2. *The exclusive allocation of a channel to one of the two measurements is made by programming the relevant coefficient; so, during a measurement programming, it is necessary to define as not programmed (R-.---) the variable of a coefficient belonging to the* **other measurement**, *if visible.*
3. *The variable of the measurement coefficient relevant to a channel, as soon as it is allocated to a measurement, is no longer visible in the other measurement.*

*

NOTE: programming of the measuring formula

The programming of the measurement formula consists in programming the K_i coefficients of the mathematical expression that connects the signals of the sensors to each other:

$$MEASURE = K_1A^* + K_2B^* + K_3C^* + K_4D^* + K_5CH.BUS1^* + K_6CH.BUS2^* + K_7CH.BUS3^* + K_8CH.BUS4^*$$

In this expression, A*, for instance, indicates the signal of the sensor connected to channel A; CH.BUS4* indicates the signal of channel 4 of the bus for the transfer of the signals coming from adjacent columns.

The sensor signal is positive when the contact is pressed and negative when it is released.

The K_i coefficients expressed in the measurement formula are non dimensional in the case of distance measurements and dimensional in the case of angle or mass measurements.
For the determination of the K_i coefficients, the following considerations are valid:

- **Distance measurements:**

  The coefficients of the measurement formulas are the ones that are used normally: for example, the measurement of an outside diameter can be expressed by the formula

  $MEASURE = K_1A^* + K_2B^*$ where K_1 and $K_2 = +1$

- **Angle measurements:**

  In the case of angle measurements, the system assumes that the sensors are placed at a mutual distance to each other or to the fulcrum, D, equal to 50,000 μm or 2,000 $''/10^{-3}$, depending on whether the M.SYST=variable is METRIC or IMPERIAL. The measurement formula is:

  $M1 = A^* - B^*$ or $M1 = B^* - A^*$

  If the sensors are placed at a different distance, it is necessary to introduce into the measurement formula two correction factors, K_1 and K_2, which allow for the ratio of the assumed distance to the actual one. The measurement formula becomes:

  $M1 = K_1A^* + K_2B^*$

  where K1=(50,000/distance between contacts in microns)
  and K2=-(50,000/distance between contacts in microns),
  or K1=(2,000/distance between contacts in thousandths of an inch)
  and K2=-(2,000/distance between contacts in thousandths of an inch),

  depending on whether the M.SYST = variable is METRIC or IMPERIAL.

- **Mass measurements:**

  The column has a resolution of one tenth of a gram. The mass measuring system can use a linear system for the transduction from mass to displacement by means of LVDT, HBT or MRT sensors.
  The K coefficient to be used in the measurement formula

  $M1 = K\ A^*$

  must be expressed in grams/μm.

The figure below shows the variables **'SHIFTS# ='**, **'SHIFT1 ='**, **'SHIFT2 ='**, **'RESOLUT ='** the data that can be associated to them and the keys that must be pressed in order to select the options.

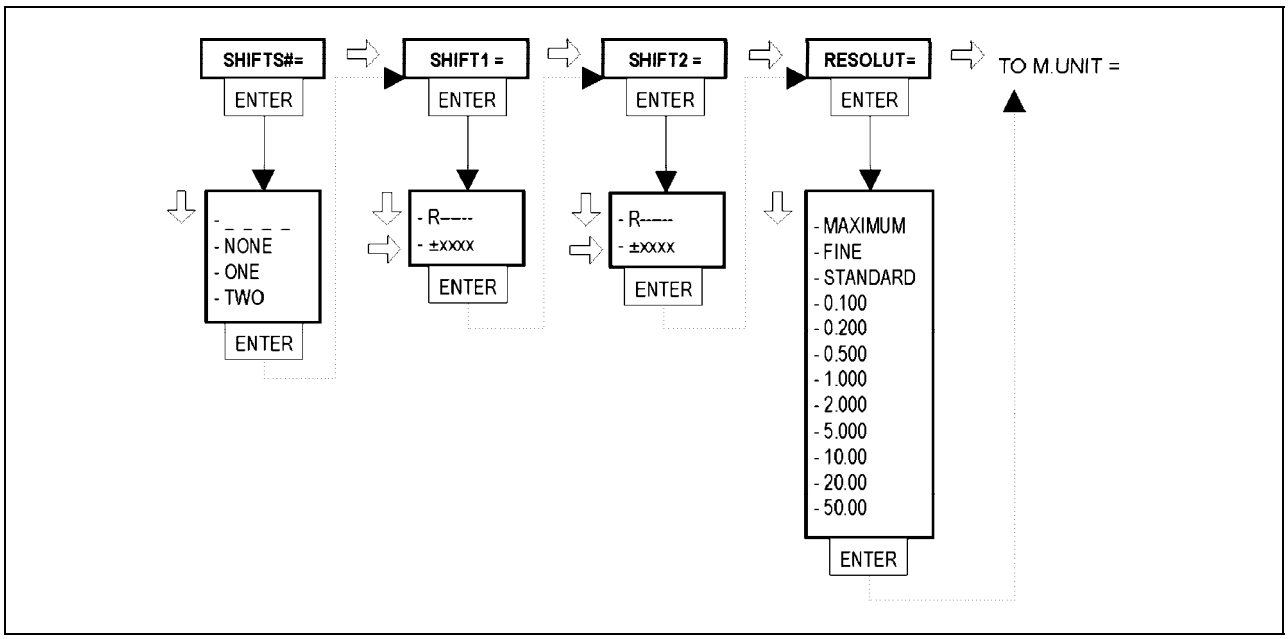


Figure 29. 'MEASURE :' menu

SHIFTS# = number of zero shift to be applied to the measurement;

type of datum: predefined; only one of the following options can be chosen:

--------	value to be replaced with one of the following;
NONE	no zero shifts are applied;
ONE	one zero shift is applied;
TWO	two zero shifts are applied.

Notes:

1. *If two measurements have been programmed, the* **SHIFTS# =** *variable is visible only with the first measurement; the value that has been programmed for it is shared by both the measurements.*
2. *The programming of the* **SHIFTS# =** *variable determines the visibility of the* **'SHIFT 1 ='** *and* **'SHIFT 2 ='**. *variables. In particular,* **'SHIFT 1 =** *is visible if* **'SHIFTS# = ONE'** *or* **'SHIFTS# = TWO'** *has been programmed;* **'SHIFT 2 =** *is visible if* **'SHIFTS# = TWO'** *has been programmed.*

SHIFT 1 = single zero shift, or the first of two to be applied to the measurement;

type of datum: numerical with sign; only one of the following options can be chosen:

- R----.- ; not programmed;
- ±xxxx.x ; numerical value whose format depends on the value that has been programmed for the **M.UNIT** = variable.

SHIFT 2 = second of two zero shifts to be applied to the measurement;

type of datum: numerical with sign; only one of the following options can be chosen:

- R----.- ; not programmed;
- ±xxxx.x ; numerical value whose format depends on the value that has been programmed for the **M.UNIT** = variable.

* **Note**

The **zero shift** makes it possible, by means of the same master, to measure workpieces that are geometrically similar to each other but have different dimensions, at least within the nominal range of the sensor or sensors that are used. The zero shift to be applied in order to measure workpiece B using the parameters programmed for workpiece A is defined as:

zero shift = (nom.dimens.of workpiece B) - (nom.dimens.of workpiece A)

For each measurement, two different zero shift values can be programmed.
When measuring, the operator can select, by means of an external pushbutton (2.5, "Connection of an external pushbutton box and/or footswitch to one E4N column" on page 17), the zero shift to be applied to the measurement. The zero shift that is applied is indicated by the column by the lighting up of the corresponding LED above the scale.

RESOLUT = value of resolution with which the measurement is processed and displayed;
type of datum: predefined; only one of the following options can be chosen:

- MAXIMUM;
- FINE;
- STANDARD;
- or a value connected to the programming of the **M.UNIT** = variable, according to the table below:

Table 1. Possible resolutions for each measurement unit

	MM	MICRONS	INCHES	THOU-SANDS	MILLIONS	DEGREES	MILLRADS	GRAMS
	.0001	0.100		0.005	5.000	.0001	.0005	0.100
*	.0002	0.200	0.00001	0.010	10.00	.0002	0.001	0.200
	.0005	0.500	0.00002	0.020	20.00	.0005	0.002	0.500
	0.001	1.000	0.00005	0.050	50.00	0.001	0.005	1.000
	0.002	2.000	.0001	0.100	100.0	0.002	0.010	2.000
	0.005	5.000	.0002	0.200		0.005	0.020	5.000
	0.010	10.00	.0005	0.500		0.010	0.050	10.00
*	0.020	20.00	0.001	1.000		0.020	0.100	20.00
*	0.050	50.00	0.002	2.000		0.050	0.200	50.00
*	0.100	100.0	0.005	5.000		0.100	0.500	100.0

Note: *When the following values are programmed:*

STANDARD *a value approximately equal to one thousandth of the measuring range is selected;*

FINE *a value approximately equal to 3 tenthousandths of the measuring range is selected;*

MAXIMUM *the maximum possible resolution is selected.*

* 4.5.4 'TOLER :' Menu

The programming of the tolerance limits and pre-limits makes it possible to define the values with which the measurement value is compared in order to determine its **STATUS**.
The column displays the limit values on the scale by means of two LEDs, which are orange.
The LEDs blink when they coincide with the ends of the scale.
The LEDS are not visible when the limits have been programmed beyond the ends of the scale; the operation of the scale is not impaired by such a programming.
If only the tolerance limits are programmed, three statuses are defined, according to the table below:

STATUS	CONDITION THAT HAS BEEN FOUND
RED +	Measurement > upper tolerance limit
GREEN	Lower tolerance limit ≤ measurement ≤ upper tolerance limit
RED-	Measurement < lower tolerance limit

If the tolerance pre-limits are also programmed, they must be within the tolerance limits; five statuses are defined, according to the table below:

STATUS	CONDITION THAT HAS BEEN FOUND
RED +	Measurement > upper tolerance limit
YELLOW+	Upper tolerance pre-limit < measurement ≤ upper tolerance limit
GREEN	Lower tolerance pre-limit ≤ measurement ≤ upper tolerance pre-limit
YELLOW-	Lower tolerance limit ≤ measurement < lower tolerance pre-limit
RED-	Measurement < lower tolerance limit

* The status of the measurement is indicated by the relevant change of the scale color.
* The programming of the limits and of the pre-limits is performed by programming the variables of the
* **TOLER :** menu.
* The figure below shows the variables that belong to the **TOLER :** menu, the data that can be associated
* to them and the keys that must be pressed in order to select the options.

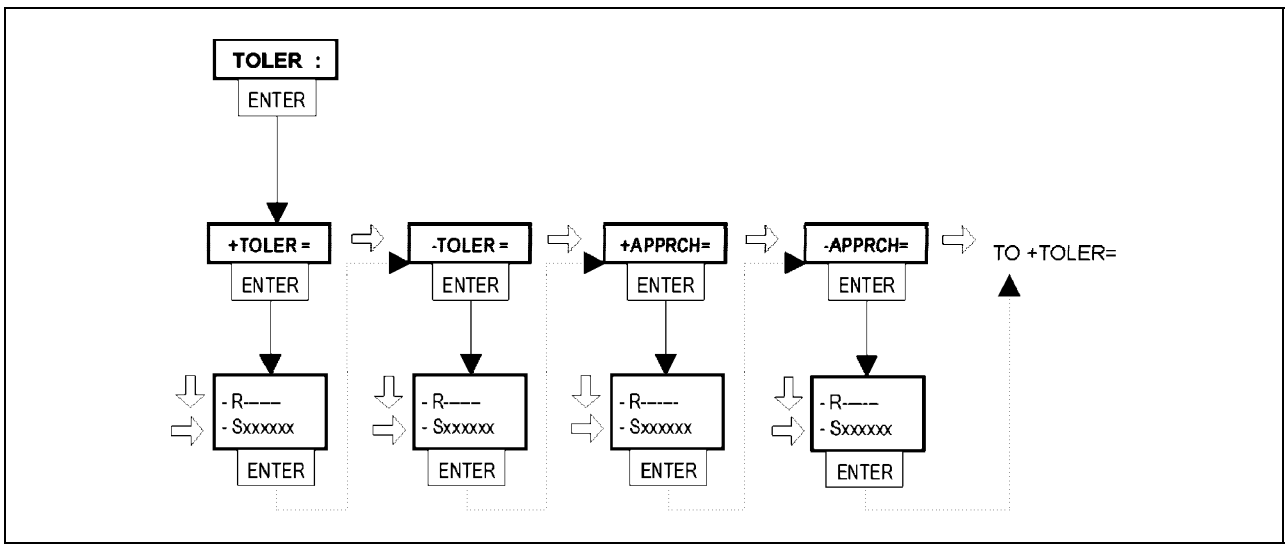


Figure 30. 'TOLER :' menu

The variables of this menu have the following meanings:

+TOLER = upper tolerance limit;

type of datum: numerical with sign; only one of the following options can be chosen:

- R----.- ; it has to be replaced with a numerical value;
- xxxx.x ; numerical value whose format depends on the value that has been programmed for variables **M.UNIT =** and **RESOLUT =**.

-TOLER = lower tolerance limit:

type of datum: numerical with sign; only one of the following options can be chosen:

- R----.- ; it has to be replaced with a numerical value;
- xxxx.x ; numerical value whose format depends on the value that has been programmed for variables **M.UNIT =** and **RESOLUT =**.

+APPRCH = Upper tolerance pre-limit;

type of datum: numerical with sign; only one of the following options can be chosen:

- R----.- ; not programmed;
- xxxx.x ; numerical value whose format depends on the value that has been programmed for variables **M.UNIT =** and **RESOLUT =**.

-APPRCH = Lower tolerance pre-limit;

type of datum: numerical with sign; only one of the following options can be chosen:

- R----.- ; not programmed;
- xxxx.x ; numerical value whose format depends on the value that has been programmed for variables **M.UNIT =** and **RESOLUT =**.

Note: *During the programming of the variables of the 'TOLER :' menu, the column checks the values that are programmed, and accepts them only if they are compatible with the following inequality:*

$$+TOLER = \geq +APPRCH = \geq -APPRCH = \geq -TOLER =$$

Only the values of the variables that have been defined up to that moment are used for the check.

4.5.5 'CLASS :' Menu

To classify a measurement means to divide the tolerance range into a definite number of intervals or *classes* having the same extension or different extensions, and to associate a number to each of these intervals, so as to make it possible to define each workpiece not only with its measurement, but also with the number or *index*, of the class to which it belongs.
If a measurement is classified, when the column is in the measuring mode the alphanumerical display shows the index associated to the class and the scale shows the measurement value.

The figures below show the variables **'CLASS#=', 'CL.TYPE=', 'LIM A/B...LIM Y/Z'** of the **CLASS :** menu, the data that can be associated to them and the keys that must be pressed in order to select the options.

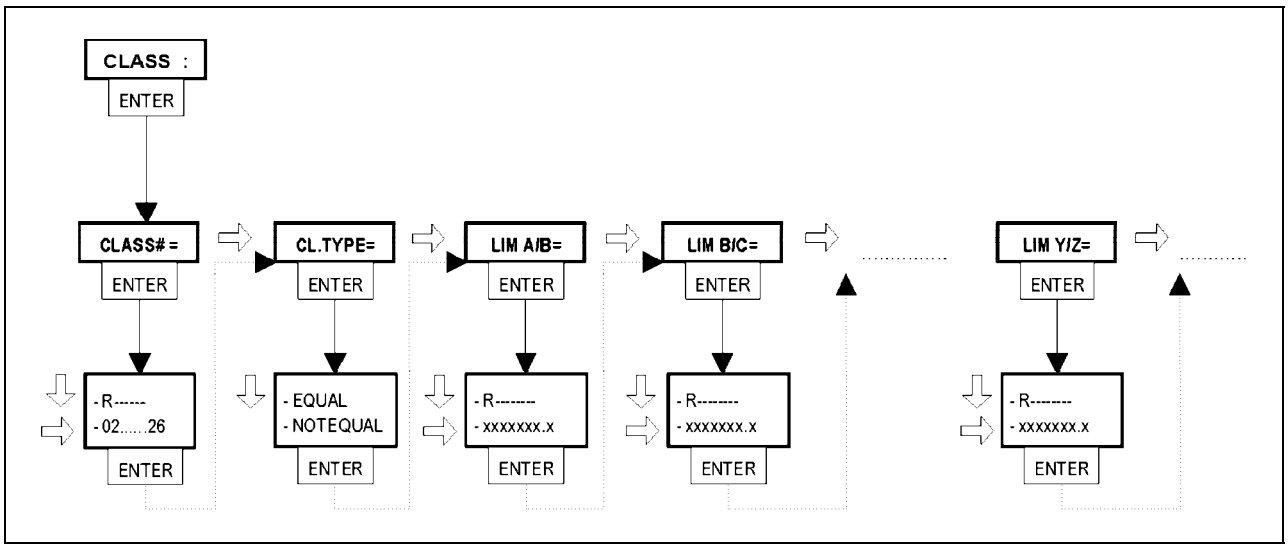


Figure 31. 'CLASS :' menu

The variables of this menu have the following meanings:

CLASS# = number of classes;

type of datum: numerical without sign; only one of the following options can be chosen:

- R -- ; not programmed;
- from 2 to 26 in steps of 1.

Note: *If for the* **CLASS# =** *variable N classes have been defined, the column shows N variables of the '***IND A =***' type and N-1 variables of the '***LIM A/B =***'* type.

CL.TYPE = mode of division of tolerance range for definition of classes;

type of datum: predefined; only one of the following options can be chosen:

EQUAL	the classes have the same extension;
NOT EQUAL	the classes have different extensions.

Note: *If for the* **CL.TYPE =** *variable the* **EQUAL** *classes have been programmed, the column calculates the limits for the separation of the classes.*

LIM A/B = limit of separation between adjacent classes;

type of datum: numerical with sign; only one of the following options can be chosen:

- -------- ; it has to be replaced with a numerical value;
- ±xxxx.x ; numerical value whose format depends on the value that has been programmed for variables **M.UNIT =** and **RESOLUT =**.

Note: *If the classes have been defined as* **EQUAL** *by means of the* **CL.TYPE =** *variable, the column displays the limits for the separation of the classes, and does not allow them to be edited.*

The figures below show the variables **IND A =, IND B =, ... IND Z=** of the CLASS menu, the data that can be associated to them and the keys that must be pressed in order to select the options.

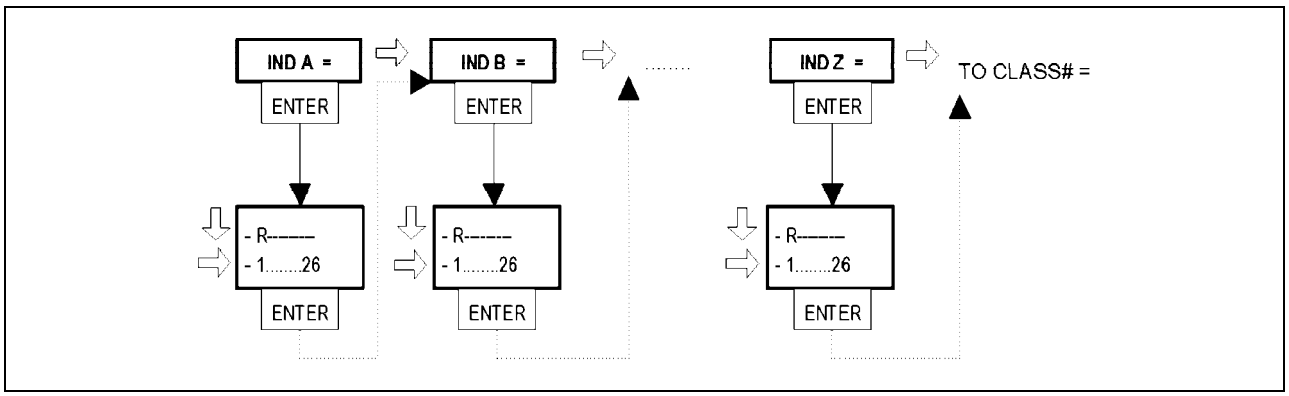


Figure 32. Indexes associated to CLASSES

IND A = index associated to class;

type of datum: numerical without sign; only one of the following options can be chosen:

- -------- ; it has to be replaced with a numerical value;
- from 1 to 26 in steps of 1.

Note: *The column proposes for each class the corresponding index; in any case the programmer can accept the proposed option or edit another one.*

4.5.6 Programming of Display Mode

For the programming of the display mode, the column makes available the '**SCALE =**' variable and the '**DISPLAY :**' menu.

The figure below shows the '**SCALE =**' variable and the variables belonging to the '**DISPLAY :**' menu, the data that can be associated to them and the keys that must be pressed in order to select the options.

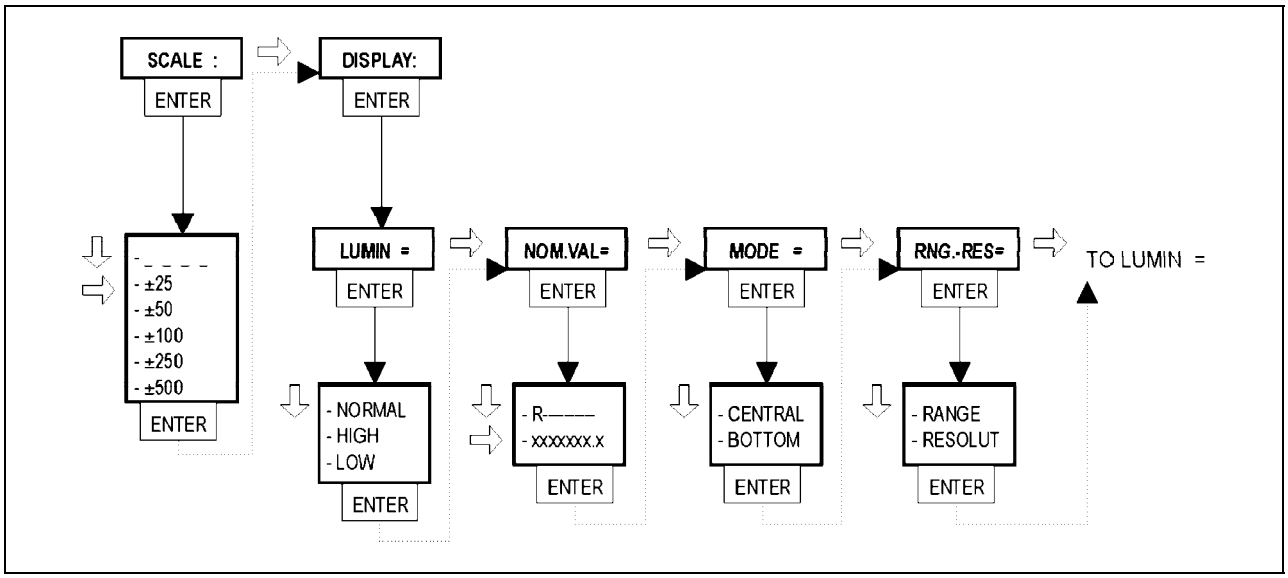


Figure 33. 'SCALE =' variable and 'DISPLAY :' menu

The '**SCALE =**' variable has the following meaning:

SCALE = is the full scale value of the analog bargraph scale;

type of datum: predefined; only one of the values in the table below can be chosen:

Table 2. Possible ranges for each measurement unit

	MM	MICRONS	INCHES	THOU-SANDS	MILLIONS	DEGREES	MILLRADS	GRAMS
	±0.005	±5.000		±0.250	±250.0	±0.005	±0.025	±5.000
*	±0.010	±10.00	±0.0005	±0.500	±500.0	±0.010	±0.050	±10.00
*	±0.025	±25.00	±0.0010	±1.000	±1000	±0.025	±0.100	±25.00
*	±0.050	±50.00	±0.0025	±2.500	±2500	±0.050	±0.250	±50.00
	±0.100	±100.0	±0.005	±5.000	±5000	±0.100	±0.500	±100.0
	±0.250	±250.0	±0.010	±10.00		±0.250	±1.000	±250.0
	±0.500	±500.0	±0.025	±25.00		±0.500	±2.500	±500.0
	±1.000	±1000	±0.050	±50.00		±1.000	±5.000	±1000
	±2.500	±2500	±0.100	±100.0		±2.500	±10.00	±2500
	±5.000	±5000	±0.250	±250.0		±5.000	±25.00	±5000

Note: *During the programming, the column displays, for the variable, only the values that are compatible with the programming that has already been performed for the '***RESOLUT** *=' variable.*

During the measurement, if the limit programmed for the scale is exceeded, the scale blinks; the color of the scale when it blinks depends on the **STATUS** *of the workpiece.*

The variables of the '**DISPLAY** ' menu have the following meanings:

LUMIN = brightness of scale;

type of datum: predefined; only one of the following options can be chosen:

NORMAL	normal brightness;
HIGH	high brightness;
LOW	low brightness.

NOM.VAL = nominal value of measurement;

type of datum: numerical; only one of the following options can be chosen:

- R----.- ; not programmed;
- xxxxxxx.x ; numerical value in range 0000000.0/9999999.9, with resolution 0.1.

If variable NOM.VAL = is programmed, that is with a value different from zero, the column automatically displays the measurement absolute value.
If variable NOM.VAL = is not programmed, the column automatically displays the measurement relative value.

MODE = mode of display of luminous bar representing the measurement;

type of datum: predefined; only one of the following options can be chosen:

CENTRAL	the LED bar lights up starting from the center of the scale;
BOTTOM	the LED bar lights up starting from the bottom of the scale.

RNG-RNS = selection of range or resolution;

type of datum: predefined; only one of the following options can be chosen:

RANGE	in measurement mode, the 4-digit display shows the range of the scale;
RESOLUT	in measurement mode, the 4-digit display shows the resolution of the scale.

Note: *In measurement mode, if* **ENTER** *is pressed there is a transition from range to resolution and viceversa.*

4.5.7 'MASTER :' Menu

The measurements performed by the column are always relevant to the nominal dimension of a master, so they must be 'calibrated' by means of a special cycle.
A measurement can be calibrated using

one master for the correction of the 'zero';
two masters for the correction of the 'zero' and of the sensitivity.

The figure below shows the variables of the '**MASTER :**' menu, the data that can be associated to them and the keys that must be pressed in order to select the options.

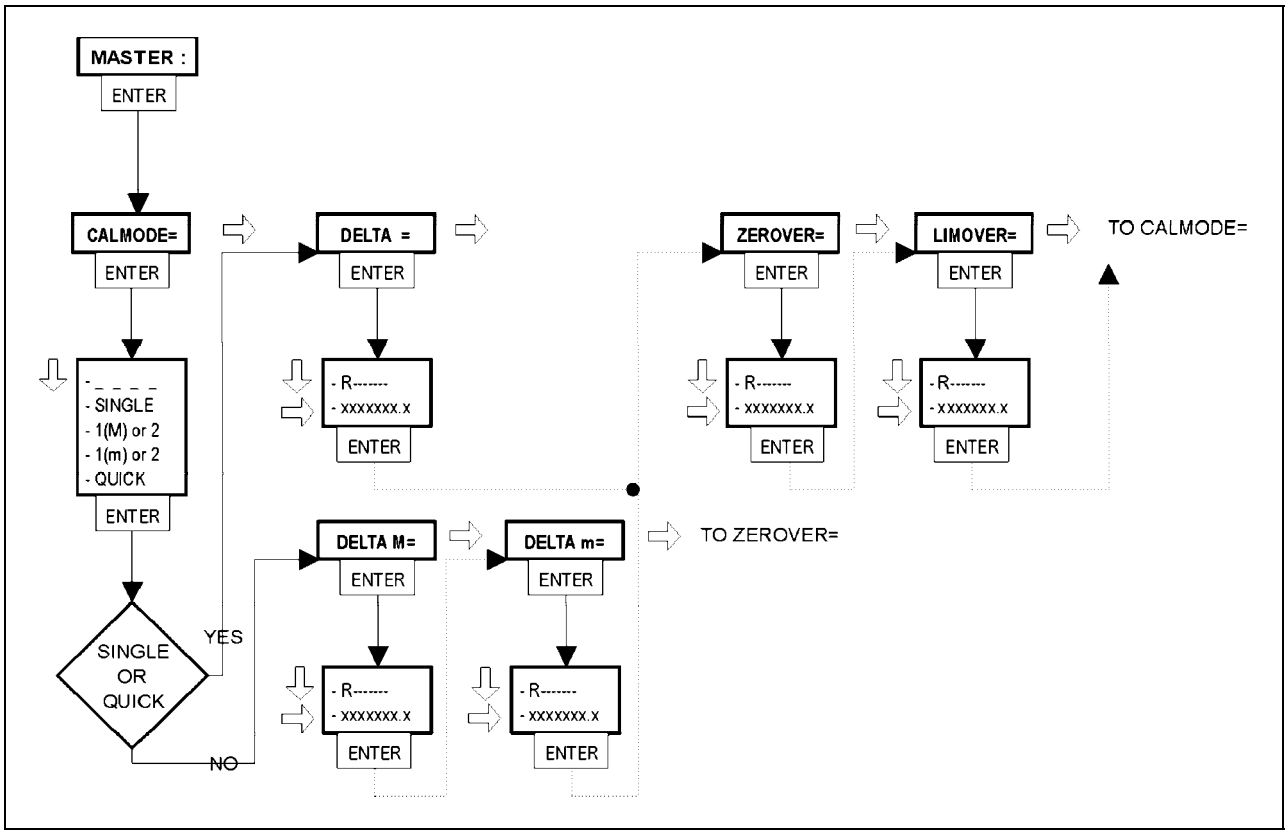


Figure 34. 'MASTER :' menu

Note: *If two measurements have been programmed, the calibration is performed in the same way for both.*

When the calibration is performed with two masters (maximum master and minimum master), during the programming the column checks the actual values of the two masters. The check takes place as follows: the interval (that is the distance in absolute value) between the actual dimension of the maximum master and the actual dimension of the minimum master must be ≥66% of the tolerance range. If this condition is not met, the values are not accepted.

The variables of this menu have the following meanings:

CALMODE = selection of mode of calibration;

type of datum: predefined; only one of the following options can be chosen:

--------	value to be replace with one of the following;
SINGLE	calibration with a single master;
1(M) or 2	calibration with one master, the maximum one, or with two masters; the decision is left to the operator at the moment of the calibration;
1(m) or 2	calibration with one master, the minimum one, or with two masters; the decision is left to the operator at the moment of the calibration;
QUICK	calibration with one master and immediate return to measuring mode.

Note: *The programming of the* **CALMODE =** *variable determines the visibility of the '***DELTA =***', '***DELTA M =***', and '***DELTA m =***' variables. In particular, '***DELTA =** *is visible if '***CALMODE=SINGLE***' or '***CALMODE=QUICK***'; '***DELTA M=** *and '***DELTA m=** *are visible if '***CALMODE = 1(M) or 2***' or '***CALMODE = 1(m) or 2**

DELTA = (actual dimension of master) - (nominal dimension of workpiece)

type of datum: numerical with sign; only one of the following options can be chosen:
- R----.- ; it has to be replaced with a numerical value;
- ±xxxx.x; numerical value whose format depends on the value that has been programmed for variables **M.UNIT=** and **RESOLUT=**.

DELTA M = (actual dimension of maximum master) - (nominal dimension of workpiece)

type of datum: numerical with sign; only one of the following options can be chosen:
- R----.- ; it has to be replaced with a numerical value;
- ±xxxx.x; numerical value whose format depends on the value that has been programmed for variables **M.UNIT=** and **RESOLUT=**.

DELTA m = (actual dimension of minimum master) - (nominal dimension of workpiece)

type of datum: numerical with sign; only one of the following options can be chosen:
- R----.- ; it has to be replaced with a numerical value;
- ±xxxx.x; numerical value whose format depends on the value that has been programmed for variables **M.UNIT=** and **RESOLUT=**.

ZEROVER = accepted value for maximum absolute deviation of calibration zero;

type of datum: numerical with sign; only one of the following options can be chosen:
- R----.- ; it has to be replaced with a numerical value;
- ±xxxx.x; numerical value whose format depends on the value that has been programmed for variables **M.UNIT=** and **RESOLUT=**.

LIMOVER = accepted value for maximum incremental deviation of calibration zero;

type of datum: numerical with sign; only one of the following options can be chosen:
- R----.- ; it has to be replaced with a numerical value;
- ±xxxx.x; numerical value whose format depends on the value that has been programmed for variables **M.UNIT=** and **RESOLUT=**.

Notes:

Variables **CALMODE=, ZEROVER=, LIMOVER=** are not present in MASTER: menu which is in PROG L1 programming sub-mode (see the flow chart relevant to the PROG L1 short programming).

4.5.8 'COMM:' menu

The column makes it possible to transfer the measurement data to concentrators, statistical analyzers, printing unit or to an external device. The modes of communication with these devices are different and must be specified. For this purpose the column has the **'COMM :'** menu to program the protocol for the communication with these peripheral devices.

The figure below shows the variables of the **'COMM:'** menu, the data which can be associated to them and the keys that must be pressed in order to choose the options.
Since the menu has many variables, the figure has been split in two parts.

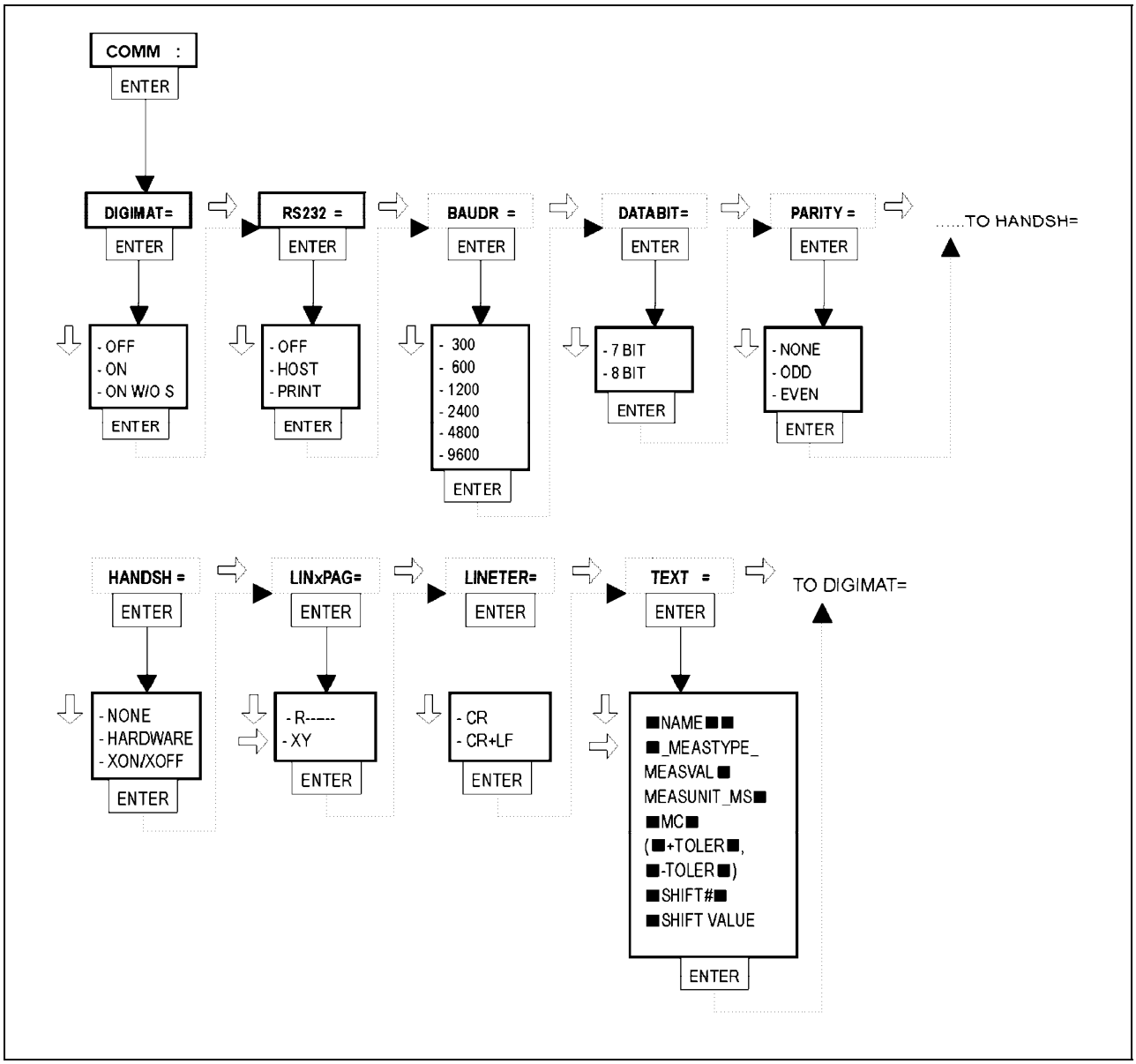


Figure 35. 'COMM:' menu

The variables of the menus have the following meanings:

DIGIMAT = enabling of transmission of measurement datum via Digimatic interface;

type of datum: predefined; only one of the following options can be chosen:

ON	Digimatic interface enabled;
ON W/O S	Digimatic interface without the measurement status enabled.
OFF	Digimatic interface disabled.

RS232 = selection of the transmission mode via RS232 interface;

type of datum: predefined; only one of the following values can be chosen:

OFF	RS232 interface disabled;
PRINT	the "PRINT" transmission mode is enabled
HOST	the "HOST" transmission mode is enabled

The paragraph 2.8.3, "RS232 Interface" on page 27 contains some more detailed information about the PRINT and HOST modes.

Note: *It is possible to display the variables relevant to the customization of the '***PRINT MODE***' protocol, when the variable '***RS232 = PRINT***' is programmed.*

BAUDR = speed of transmission in BIT/SECOND;

type of datum: predefined; only one of the following value can be chosen:

- 300
- 600
- 1200
- 2400
- 4800
- 9600

DATABIT= number of BIT/CHARACTER;

type of datum predefined; only one of the following values can be chosen:

- 7 BIT
- 8 BIT

PARITY= use mode of the parity control BIT;

type of datum predefined; only one of the following values can be chosen:

- NONE
- ODD
- EVEN

HANDSH = synchronization mode between column and external device;

type of datum predefined; only one of the following values can be chosen:

- NONE
- HARDWARE
- XON/XOFF

LIN X PAG= number of lines of measurement data included between two headings print-out (see later on the variable 'TEXT =')

type of datum: numerical without sign; only one of the following values can be choosen:

- R----.-; it has to be replaced with a numerical value;
- from 0 to 99 by one

Note: *If the zero value is assigned to the '***LIN X PAG=***' variable, a measurement data line, without heading is obtained.*

LINETER= closing mode of the values line;

type of datum: predefined; only one of the following values can be chosen:
- CR;
- CR + LF;

Note: *CR means Carriage Return*
CR + LF means Carriage Return + Line Feed

TEXT = The heading to be assigned to a set of measurement data is programmable and consists of 80 characters.

type of datum: STRING; in Figure 35 on page 63 the DEFAULT text has been carried.

Note: *If the variable '***LIN X PAG=***'*hp1. has a N value different from zero, the heading is printed each N measuring data lines.

By selecting the PRINT transmission mode (that is RS232 = PRINT) it is possible to directly transmit the measuring data to an external device via RS232.
Let us make an example:

TRANSMISSION OF THE MEASUREMENT DATA TO A PERSONAL COMPUTER

E4N PROGRAMMING:	RS232 =	PRINT
	PRINTER:	BAUDR = 9600 DATA BIT = 8 PARITY = NONE HANDSH = NONE LIN X PAG = 20 LINETER = CR + LF TEXT = 'DEFAULT'

Here following we report a BASIC PROGRAM EXAMPLE which makes it possible to transmit the measurement data to a P.C.. The request will be entered by pressing the ENTER key on the P.C. keyboard.

```
10    OPEN "COM1:9600,N,8,1" AS #1
30    INPUT "PRESS ENTER", A$
35    PRINT
40    PRINT #1, "M";
50    INPUT #1,S$
60    PS$=MID$(S$,1,8)
70    PRINT "IDENTIF =",PS$
80    PS$=MID$(S$,9,8)
90    PRINT "TYPE =",PS$
100   PS$=MID$(S$,20,8)
110   PRINT "VALUE =",PS$
120   PS$=MID$(S$,28,8)
130   PRINT "UNIT =",PS$
140   PS$=MID$(S$,37,2)
150   PRINT "STATUS =",PS$
160   PS$=MID$(S$,40,2)
170   PRINT "CLASS =",PS$
180   PS$=MID$(S$,44,8)
190   PRINT "+LIMIT =",PS$
200   PS$=MID$(S$,53,8)
210   PRINT "-LIMIT =",PS$
220   PS$=MID$(S$,62,8)
230   PRINT PS$," ",
240   PS$=MID$(S$,70,8)
250   PRINT PS$
260   PRINT
270   GOTO 30
```

4.5.9 'PASWRD:' menu

§ The column allows to define two passwords thus creating two 'USER LEVELS', each of which has an
§ access right for the system functions. In this way these functions are protected. The '**PASWRD:**' menu
§ is dedicated to the programming of the passwords.
The figure below shows the variables of the '**PASWRD:**' menu, the data which can be associated to them and the keys that must be pressed in order to choose the options.

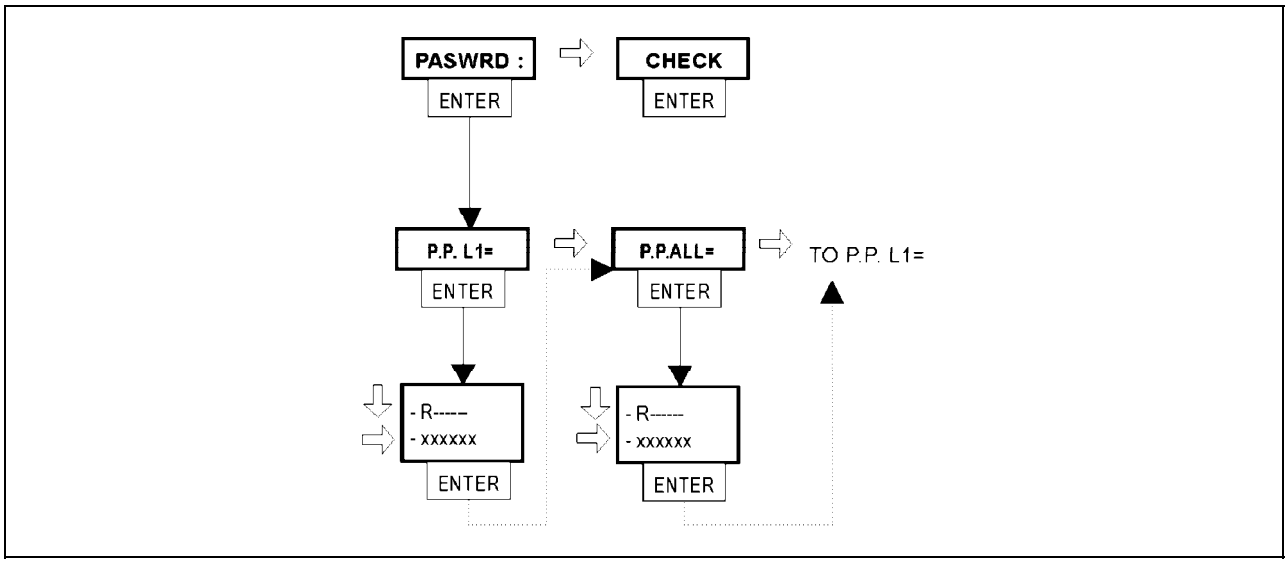


Figure 36. 'PASWRD:' menu

The variables of the menu have the following meaning:

P.P. L1= Password that determines the right of access to the menus for the **partial programming** of the column;

P.P.ALL = password that determines the right of access to the menus for the **complete programming** of the column;

type of datum: numerical with four decimal digits and no sign; only one of the following options can be chosen:
- R--- ; not programmed;
- from 0000 to 9999

*

* 4.5.10 Check and Backup of Programmed Data

When the variables of the **'COMM :'** and **'PASWRD :'** menus have been programmed, the column displays the option 'CHECK', which indicates that it is possible to request a verification of the programming that has been done. This check may be skipped, because in any case the column, before storing the programmed data, checks them automatically; or it may be performed. In the latter case, if the result of the check is unfavorable, an error message may be given which may be used to look for the cause or causes (the error messages are shown in the relevant chapter).
If the result of the check is favorable, it is possible to proceed without any further problem to the backup of the programmed data.

Below there is indicated the sequence of actions required to store the programming that has been done.

ACTION	OPERATOR	DISPLAY
		GENERAL:
Exit from PROGALL menu	press PROG	PROG L1:
Request BACKUP	press PROG	for 2 seconds these blinking symbols are shown ::::::::
At the end of this stage, if the programming has not altered any parameter of the previous programming, the column passes to the measuring state, concluding the procedure. Otherwise, if no errors are present, the column displays:		
		BACKUP
confirm BACKUP	press key ENTER	for 2 seconds these blinking symbols are shown :::::::: and after 8 seconds NO CAL

* **'NO CAL MESSAGE'** The 'NO CAL' message is given by the column to indicate that the measurement or measurements are not calibrated and that it is necessary to calibrate them.
The message is not given if during the programming no changes have been made on the variables that affect the calibration.

* **'ERROR MESSAGE'** If instead of the 'BACKUP' message an error message is given, this means that the column has found some errors in the programming. In this case, press ENTER, in order to obtain the BACKUP display again, then press ENTER again in order to store the programmed data and to save the editing that has been performed. At the end of the BACKUP stage the column gives a 'not ready' message: **N READY** and the operator has to return to the "PROGRAMMING MODE" in order to eliminate the error.

* 4.5.11 Restore of Programmed Data

If the operator does not wish to proceed to the BACKUP of the programmed data, but wishes to restore the previous situation, when the display shows the BACKUP message he must act as follows:

1. press pushbutton RIGHT, in order to display the RESTORE message;
2. confirm the restore of the previous programming by pressing ENTER.

When the programming has been exited, the column returns to the mode in which it was before the programming.

4.5.12 Reset of programmed data

In case of programming of an E4N column which had been already programmed in the past (i.e. a column that was used, for a period, to carry out two diameter measurements and then wanted to be used for a distance measurement) it is possible for the operator to reset the programmed data and restart with a new programming.
The RESET function will allow this operation.
To reset the programmed data the column display must display:



this means that one programming parameter at least has been changed and the column suggests to save it.
Then, follow the procedure:

1. press the RIGHT key twice so as to display the RESET message
2. confirm the programming RESET by pressing the ENTER key

Now the column has to be entirely reprogrammed.

4.6 Example of Programming

§ The example uses programming sheets that are included in the Appendix; the programmer can use
§ these sheets for his own application, after obtaining photostatic copies of them.

Each sheet indicates the variables of the menus with the data that have been associated to them. If two measurements are programmed, it is shown clearly which data refer to the first one and which to the second one.

Let us suppose we must measure workpieces P1 and P2: see Figure 37 and Figure 38 on page 71. These workpieces arrive in mixed batches to the measuring station, which is formed by two bench gauges equipped with two Marposs LVDT pencil probes AF100.

The measurement data of the workpieces are:

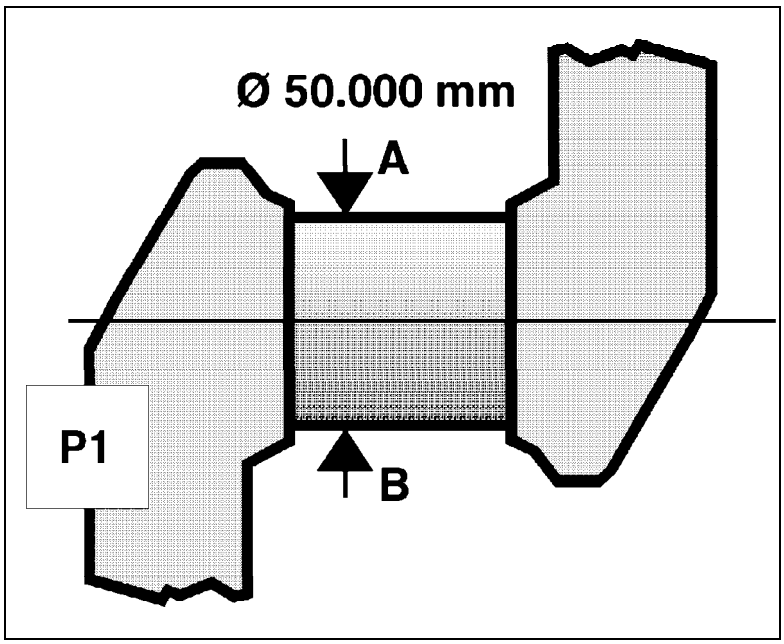


Figure 37. Workpiece P1

Workpiece P1:

- Nominal dimension 50,000 mm
- Tolerance limits ±750 µm
- Tolerance pre-limits ±500 µm
- Classification into 3 classes having equal size.

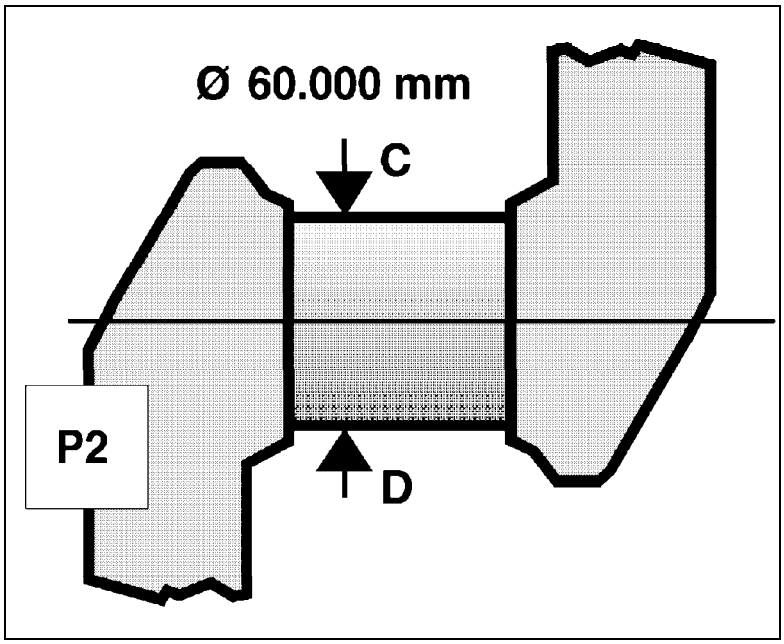


Figure 38. Workpiece P2

Workpiece P2:

- Nominal dimension 60,000 mm
- Tolerance limits ±750 μm
- Classification into 3 classes having equal size.

Workpiece P1 is associated to measurement 1; workpiece P2 is associated to measurement 2. Measurement 1 is associated to channels A and B; measurement 2 is associated to channels C and D.

This measuring problem is solved by means of the programming that is shown in the following pages, which reproduce the programming sheets included in the Appendix.

For both the measurements, the calibration mode 1 (M) or 2 has been adopted and the maximum and minimum master are used.

INSTRUCTIONS FOR THE OPERATOR

Never introduce the workpieces simultaneously into the two measuring stations.

4.6.1 Programming Data

E4N - APPLICATION DATA

GENERAL:

	LANGUAG =	[√]ENGLISH [ ]ITALIANO [ ]FRANCAIS [ ]DEUTSCH [ ]ESPANOL
	M.SYST =	[√] METRIC [ ] IMPERIAL
	ASWITCH =	[ ] SINGLE [√] DOUBLE
	POWERON =	[√] MEASURE [ ] CALIBR
£	O.R.CK =	[√] OFF
£		[ ] ON
	IDENTIF =	[TEST]

SHEET 1/8

E4N - APPLICATION DATA

CHANNEL:

CH.A :

SELECT =	[√] ON [ ] OFF
TR.NUM =	[01]
TR.TYPE=	[√] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[1.000]
TR.RNG =	[1000]
A.RATIO=	[1.000]

CH.B :

SELECT =	[√] ON [ ] OFF
TR.NUM =	[02]
TR.TYPE=	[√] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[1.000]
TR.RNG =	[1000]
A.RATIO=	[1.000]

CH.C :

SELECT =	[√] ON [ ] OFF
TR.NUM =	[03]
TR.TYPE=	[√] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[1.000]
TR.RNG =	[1000]
A.RATIO=	[1.000]

CH.D :

SELECT =	[√] ON [ ] OFF
TR.NUM =	[04]
TR.TYPE=	[√] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[1.000]
TR.RNG =	[1000]
A.RATIO=	[1.000]

CHANNEL: (continue)

CH.BUS1:

SELECT =	[ ] ON [√] OFF
TR.NUM =	[__]
TR.TYPE=	[ ] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG =	[____]
A.RATIO=	[_.___]

CH.BUS2:

SELECT =	[ ] ON [√] OFF
TR.NUM =	[__]
TR.TYPE=	[ ] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG =	[____]
A.RATIO=	[_.___]

CH.BUS3:

SELECT =	[ ] ON [√] OFF
TR.NUM =	[__]
TR.TYPE=	[ ] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG =	[____]
A.RATIO=	[_.___]

CH.BUS4:

SELECT =	[ ] ON [√] OFF
TR.NUM =	[__]
TR.TYPE=	[ ] NORMAL [ ] WIDE RNG [ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG =	[____]
A.RATIO=	[_.___]

SHEET 2/8

E4N - APPLICATION DATA

MEAS.N.1

MEASURE:

M.UNIT =	[ ] MM [√] MICRON [ ] DEGREE [ ] MILLRAD [ ] GRAM [ ] INCH [ ] THOUSAND [ ] MILLIONS
M.TYPE =	[√] STATIC [ ] MAX [ ] min [ ] (M + m)/2 [ ] (M-m)/2 [ ] M-m
RESPON =	[ ] FAST [√] NORMAL [ ] SLOW
£ A.S.LEV =	[R---.-]
K.CH.A =	[+1.000]
K.CH.B =	[+1.000]
K.CH.C =	[R-.---]
K.CH.D =	[R-.---]
SHIFTS# =	[√] NONE [ ] ONE [ ] TWO
RESOLUT =	[√] STANDARD [ ] FINE [ ] MAXIMUM [____]

TOLER :

+TOLER =	[_+0750.0]
-TOLER =	[_-0750.0]
+APPRCH =	[_+0500.0]
-APPRCH =	[_-0500.0]

E4N - APPLICATION DATA

MEAS.N.1

CLASS :

CLASS#= [03]

CL.TYPE= [√_] EQUAL
[__] NOTEQUAL

LIM A/B= [_____]
LIM B/C= [_____]

CLASS : (continue)

IND A = [_1]
IND B = [_2]
IND C = [_3]

SHEET 4/8

E4N - APPLICATION DATA

MEAS.N.1

SCALE = [+/-1000_]

DISPLAY:

LUMIN = [__] HIGH
[√_] NORMAL
[__] LOW

NOM.VAL = [050000.0]

MODE= [√_] CENTRAL
[__] BOTTOM

RNG-RES= [√_] RANGE
[__] RESOLUT

MASTER :

CALMODE = [__] QUICK
[__] SINGLE
[√_] 1(M) o 2
[__] 1(m) o 2

DELTA M= [_+0770.0]
DELTA m= [_-0735.0]

ZEROVER= [__0100.0]
LIMOVER= [__0020.0]

E4N - APPLICATION DATA

MEAS.N.2

MEASURE:

	M.UNIT=	[ ] MM [√] MICRON [ ] DEGREE [ ] MILLRAD [ ] GRAM [ ] INCH [ ] THOUSAND [ ] MILLIONS
	M.TYPE =	[√] STATIC [ ] MAX [ ] min [ ] (M + m)/2 [ ] (M-m)/2 [ ] M-m
	RESPON =	[ ] FAST [√] NORMAL [ ] SLOW
£	A.S.LEV=	[0800.0]
	K.CH.C =	[+1.000]
	K.CH.D =	[+1.000]
	SHIFTS#=	[√] NONE [ ] ONE [ ] TWO
	RESOLUT=	[√] STANDARD [ ] FINE [ ] MAXIMUM [____]

TOLER :

+TOLER =	[_+0750.0]
-TOLER =	[_-0750.0]
+APPRCH=	[_+0500.0]
-APPRCH=	[_-0500.0]

SHEET 6/8

E4N - APPLICATION DATA

MEAS.N.2

CLASS :

CLASS#=	[03]
CL.TYPE=	[√_] EQUAL
	[__] NOTEQUAL
LIM A/B=	[_____]
LIM B/C=	[_____]

CLASS : (continue)

IND A =	[_1]
IND B =	[_2]
IND C =	[_3]

SHEET 7/8

E4N - APPLICATION DATA

MEAS.N.2

SCALE = [+/-1000]

DISPLAY

LUMIN = [__] HIGH
[√_] NORMAL
[__] LOW

NOM.VAL = [060000.0]

MODE = [__] CENTRAL
[√_] BOTTOM

RNG-RES = [√_] RANGE
[__] RESOLUT

MASTER :

CALMODE = [__] QUICK
[__] SINGLE
[√_] 1(M) o 2
[__] 1(m) o 2

DELTA M = [_+0670.0]
DELTA m = [_-0835.0]

ZEROVER = [__0100.0]
LIMOVER = [__0020.0]

E4N - APPLICATION DATA

COMM :

DIGIMAT = [__] ON
[__] ON W/O S
[√_] OFF

RS232 = [√_] OFF
[__] PRINT
[__] HOST

PASWRD :

P.P. L1 = [9012]
P.P.ALL = [3456]

SHEET 8/8

Chapter 5. Adjustment (ADJ)

In this mode the column displays the values of the individual sensors connected to it, in order to make it possible to carry out their mechanical positioning. A typical case of the use of this mode is that in which the column refuses the calibration because of an excessive wear of the contacts on the bench gauge.

The adjustment mode is available even if the column is not equipped with a programming module. In ADJUSTMENT mode the color of the LED scale is only green.
During the transducers ADJUSTMENT phase, the upper display shows if the sensor is in positive (+o.r.) or in negative over range (-o.r.). This, will help the operator during the zero setting stage, especially when the mechanical shiftings are small.

5.1 Adjusting procedure for LVDT-MRT-HBT sensors

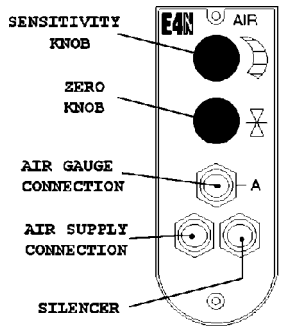
1. Simultaneously press the CAL and ENTER keys for at least 2 seconds.
2. After 2 seconds the column warns the operator that the ADJUSTMENT mode has been entered by showing the message ADJ0 on the 7-segment display at the top; if there is a programmer module, the message ADJ is shown on its alphanumerical display.
3. When the pushbuttons are released, the column shows, in the display at the top, alternatively the name of the first active channel of the module for the amplification of the sensor signals, for instance CH A, and the range of display for the led scale, whose value is the one that contains and is nearest to the TR.RNG value programmed for the working range of the transducer.
4. As soon as the measuring device has been applied to the master, the column displays, on the scale and on the display of the programmer module, if present, the value, expressed in microns or thousandths of an inch, of the mechanical deviation of the sensor from its reference position, and, by means of two LEDs that light up on the scale, the value programmed for the range of the sensor; the display on the scale is from the bottom up.
5. Mechanically shift the sensor in order to bring the deviation displayed on the scale as near as possible to zero.
6. Press ENTER to pass to the next active channel of the amplifier module, for instance CH B.
7. Repeat the previous operations for all the sensors connected to the column.
8. Press the CAL pushbutton in order to quit the submode and to pass to the measurement mode.
9. Press the CAL pushbutton in order to enter the CALIBRATION MODE and perform the calibration.

5.2 Adjusting procedure for AIR/ELECTRONIC sensors

The adjustment phase for A/E sensors starts with the regulation of the supply pressure to be performed with the help of a pressure reducer unit and of a manometer. It is good to remember the "Ideal" supply pressure is of 3 bars; the converter works anyway with a supply pressure going from 1.5 to 4 bars.
Ended such phase you can proceed as follows:

1. simultaneously press for at least two seconds the buttons CAL and ENTER.
2. after two seconds, the column informs the user it passed to ADJUSTMENT mode, visualizing on the higher 7-segment display the message "ADJ0"; the ADJ message is displayed by the alphanumerical display of the programming module, if present.
3. releasing the buttons, the column alternatively visualizes in the higher display the active channel of the amplifier module, i.e. channel A, and the meter visualization range whose value is the one that contains and is nearest to the TR.RNG value programmed for the working range of the transducer.

4. the two A/E converter module knobs (Sensitivity and Zero) are still completely closed, that is fully screwed towards right.



To proceed with the adjustment, it is necessary to have two masters, *MAX. master* and *min. master*; they will respectively have two real values called *V.MAX* and *V.min*.
First of all we have to reckon the distance, in absolute value, between the two masters:

$$d = V.MAX - V.min$$

For example, in case:

upper tolerance limit = +20
lower tolerance limit = 0

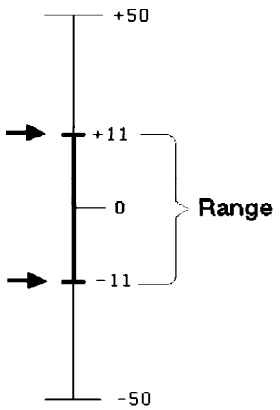
and

$$V.MAX = +21 \qquad V.min = -1$$

we have:

$$d = V.MAX - V.min = 21 - (-1) = 22$$

To perform a correct adjustment, the sensor must work around the zero that is, considering the above example:



Therefore the value to consider is d/2. It is advisable to stick on the meter two indicators corresponding to the two values.

Now we have two situations:

1) **EXTERNAL MEASUREMENT (ring or snap gauge)**
the user has to:

- insert the MAX. master in the measurement position and turning the sensitivity knob up to read on the meter, the value + d/2 (with reference to the above example = +11)
- remove the MAX. master
- insert the min. master in measurement position and turning the zero knob up to read on the meter the value - d/2 (with reference to the above example = -11)
- remove the min. master
- insert the MAX. master in the measurement position, if the read value is different from + d/2, turn the sensitivity knob to reach the value of + d/2
- remove the MAX. master
- the procedure goes on inserting the min. master in measurement position and acting on the zero knob until the value -d/2 is displayed.
  Following the same procedure many times, you will reach the desired value; once the goal is attained, the sensitivity and zero knobs must **not be touched** (except in case the adjustment procedure must be repeated from the beginning).

2) **INTERNAL MEASUREMENT (plug)**
the user now has to:

- insert the MAX. master in measurement position and turning the sensitivity knob up to read the value - d/2 (this is due to the fact that in this case the measurement sign is inverted as well as the sign relevant to the two master values).
- remove the MAX master
- insert the min master in measurement position; with the zero knob he should read the value + d/2
- remove the min master
- insert the MAX master in measurement position; if the read value is different from the - d/2, with the sensitivity knob he has to reach the value of - d/2
- remove the MAX. master
- the procedure goes on inserting the min master in measurement position and acting on the zero knob until the value +d/2 is displayed.
  Following the same procedure many times, you will reach the desired value; once the goal is attained, the sensitivity and zero knobs **must not be touched** (except in case the adjustment procedure must be repeated from the beginning).

* 5. Press the CAL pushbutton in order to quit the sub-mode and to pass to the measurement mode.

* 6. Press the CAL pushbutton in order to enter the calibration mode and perform the calibration.

Chapter 6. Calibration

When the CAL key is pressed for at least 2 seconds, the system passes to the CALIBRATION MODE. Depending on the programming that has been performed, 2 different types of calibration may be presented:

- CALIBRATION with one master;
- CALIBRATION with two masters (a maximum one and a minimum one) .

The calibration with a single master is performed in one step; it updates the zero-setting correction of the measurement.

The calibration with two masters is carried out in several successive steps; it updates both the zero-setting correction and the adjustment of the sensitivity of the measurement.

If 2 measurements with AUTOSWITCH have been programmed, the CALIBRATION MODE in actual fact consists of 2 submodes:

CALIBRATION OF MEASUREMENT 1

CALIBRATION OF MEASUREMENT 2

When the CAL pushbutton is pressed, the column passes to the CALIBRATION MODE, that is to say, it passes to CALIBRATION OF MEASUREMENT 1 or to CALIBRATION OF MEASUREMENT 2, depending on which measurement was under way at that moment.
In any case, by pressing CAL it is possible to pass from the submode CALIBRATION OF MEASUREMENT 1 to the submode CALIBRATION OF MEASUREMENT 2 or viceversa.

During these operations, the 7-segment display indicates the currently active submode, by means of the message CAL1 or CAL2.

After passing through both the submodes, if CAL is pressed again the column goes back to MEASUREMENT MODE.

To enter the submode(s), press ENTER.

The operations to be performed within the submodes are identical to the ones that will be described in the next paragraphs for the case of a single measurement.

As a general rule, once the CALIBRATION MODE has been entered, the LED scale functions within the same range that has been set for the measurement.

In CALIBRATION MODE the LEDs are only yellow-orange.

6.1 Calibration with One Master Gauge

Depending on the choice made in the programming, the calibration can be carried out in 2 ways:

- SINGLE
- QUICK

SINGLE CALIBRATION

If the CAL pushbutton is pressed for at least 2 seconds, the system enters the calibration mode. In the case of a calibration with one master gauge, the 7-segment display shows "CAL-" and on the scale there appears a limit that corresponds to the 'master delta'.

After the operator has inserted the master gauge, the scale displays the measurement of the master gauge (with respect to the last calibration that has been carried out). The measurement error is the difference between the measurement value and the displayed limit.

The operator can:

a. press ENTER to correct the zero-setting;
b. press CAL to quit the calibration mode without performing any operation.

When ENTER is pressed, the column performs the zero-setting. During this operation, the 7-segment display shows "----".

After the correction has been made, the measurement should coincide with the displayed limit. At this point, the operator can leave the calibration mode by pressing CAL or repeat the calibration by pressing ENTER.

QUICK CALIBRATION

With this procedure, all the steps described for the single calibration are carried out up to step 'a'., where ENTER is pressed to correct the zero-setting.
At this point, with the quick procedure, if the operator presses ENTER, the column performs the zero-setting and returns automatically to the MEASUREMENT MODE.
Step 'b'. is the same as for the single calibration.

6.2 Calibration with Two Masters

Depending on the choice made in the programming, the calibration with two master gauges can be carried out in two different ways:

1. mode "1(M) or 2";
2. mode "1(m) or 2";

MODE	"1(M) or 2"	"1(m) or 2"
First step	Maximum master	Minimum master
Correction at end of first step	Zero-setting	Zero-setting
Second step	Minimum master	Maximum master
Correction at end of second step	Sensitivity	Sensitivity

If the calibration is completed, there is no difference between the two modes. If the operation is interrupted after the first step by pressing CAL pushbutton:

- in the ″1(M) or 2″ mode, the zero-setting correction has been performed with the maximum master gauge;
- in the ″1(m) or 2″ mode, the zero-setting correction has been performed with the minimum master gauge.

″1(M) or 2″ mode

When the CAL key is pressed for at least 2 seconds, the system passes to the CALIBRATION MODE. The 7-segment display shows ″CAL-″.
The operator inserts the maximum master. The scale shows its measurement and a limit (yellow-orange LED) that corresponds to the deviation of the maximum master. The difference between the reading of the scale and the position of the limit represents the zero-setting error of the measurement with respect to the last calibration.

The operator can update the zero-setting correction of the measurement by pressing ENTER, or he can exit from the calibration mode by pressing CAL. While the column is correcting the zero-setting, the 7-segment display shows ″----″; at the end of the correction, it shows ″CONT″ (continue).

When the calibration has been completed, the measurement should coincide with the displayed limit. At this point the operator can quit the calibration, by pressing CAL, or continue, by pressing ENTER.

In the latter case the 7-segment display shows ″CAL_″ to indicate that the operator must insert the minimum master, and the scale shows a limit that corresponds to the deviation of the minimum master.
After the operator has inserted the minimum master, the difference between the reading on the scale and the position of the limit represents the sensitivity error of the measurement.

The operator can press ENTER to correct the sensitivity or CAL to quit the calibration mode.
When ENTER is pressed, the column performs the correction of the sensitivity. During this operation, the 7-segment display indicates ″----″, and, at the end, ″DONE″.

N.B.: if the operation has a good result the upper display shows the message ″DONE″; pressing the ″right″ pushbutton of the local programmer (just for E4N with local programming module) the lower alphanumerical display shows the performed sensitivity adjustment.

For example: $S = 1.040$
means that the performed adjustment corresponds to +4%.

At this point the operator can quit the calibration mode by pressing CAL, or repeat the operation by pressing ENTER.

″1(m) or 2″ mode

When the CAL key is pressed for at least 2 seconds, the system passes to the CALIBRATION MODE. The 7-segment display shows ″CAL_″.
The operator inserts the minimum master. The scale displays the measurement and a limit (yellow-orange LED), which corresponds to the deviation of the minimum master gauge. The difference between the scale reading and the position of the limit represents the zero-setting error of the measurement with respect to the last calibration.

By pressing ENTER, the operator updates the correction of the zero-setting of the measurement; by pressing CAL, he can exit from the calibration mode. While the column is correcting the zero-setting, the 7-segment display shows ″----″; at the end of the operation it shows ″CONT″ (continue).

When the calibration has been completed, the measurement should coincide with the displayed limit. At this point, the operator can quit the calibration mode, by pressing CAL, or continue, by pressing ENTER.

In the latter case the 7-segment display shows "CAL-", in order to indicate that the maximum master must be inserted. The scale shows a limit that corresponds to the deviation of the maximum master.
After the operator has inserted the maximum master, the difference between the scale reading and the position of the limit represents the sensitivity error of the measurement.

The operator can press ENTER in order to correct the sensitivity, or CAL in order to exit from the calibration mode.
After the ENTER key has been pressed, the column corrects the sensitivity. During this operation, the 7-segment display shows "----" and, at the end, "DONE".

N.B.: if the operation has a good result the upper display shows the message "DONE"; pressing the "right" pushbutton of the local programmer (just for E4N with local programming module) the lower alphanumerical display shows the performed sensitivity adjustment.

For example: $S = 1.040$
means that the performed adjustment corresponds to $+4\%$.

At this point, the operator can exit from the calibration mode by pressing CAL, or repeat the calibration by pressing ENTER.

6.3 Checks Performed during the Calibration

During the updating of the corrections, several checks are performed, in order to eliminate any operator mistakes, to warn against possible operator mistakes, or to indicate a fault in the measuring system.

As regards the correction of the zero-setting, the system makes sure that:

- the correction does not exceed, in module, a programmable threshold: ZEROVER.
- the variation of the correction does not exceed, in module, a programmable threshold: LIMOVER.

If an error is found, the relevant warning is given (to eliminate the warning, press ENTER). In the first case the calibration is aborted, in the second it is carried out.

As regards the correction of the sensitivity, the system makes sure that it is less than:

- $\pm$ 5% in case of normal or wide range transducers;
- $\pm$ 25% in case of pneumatic transducer.

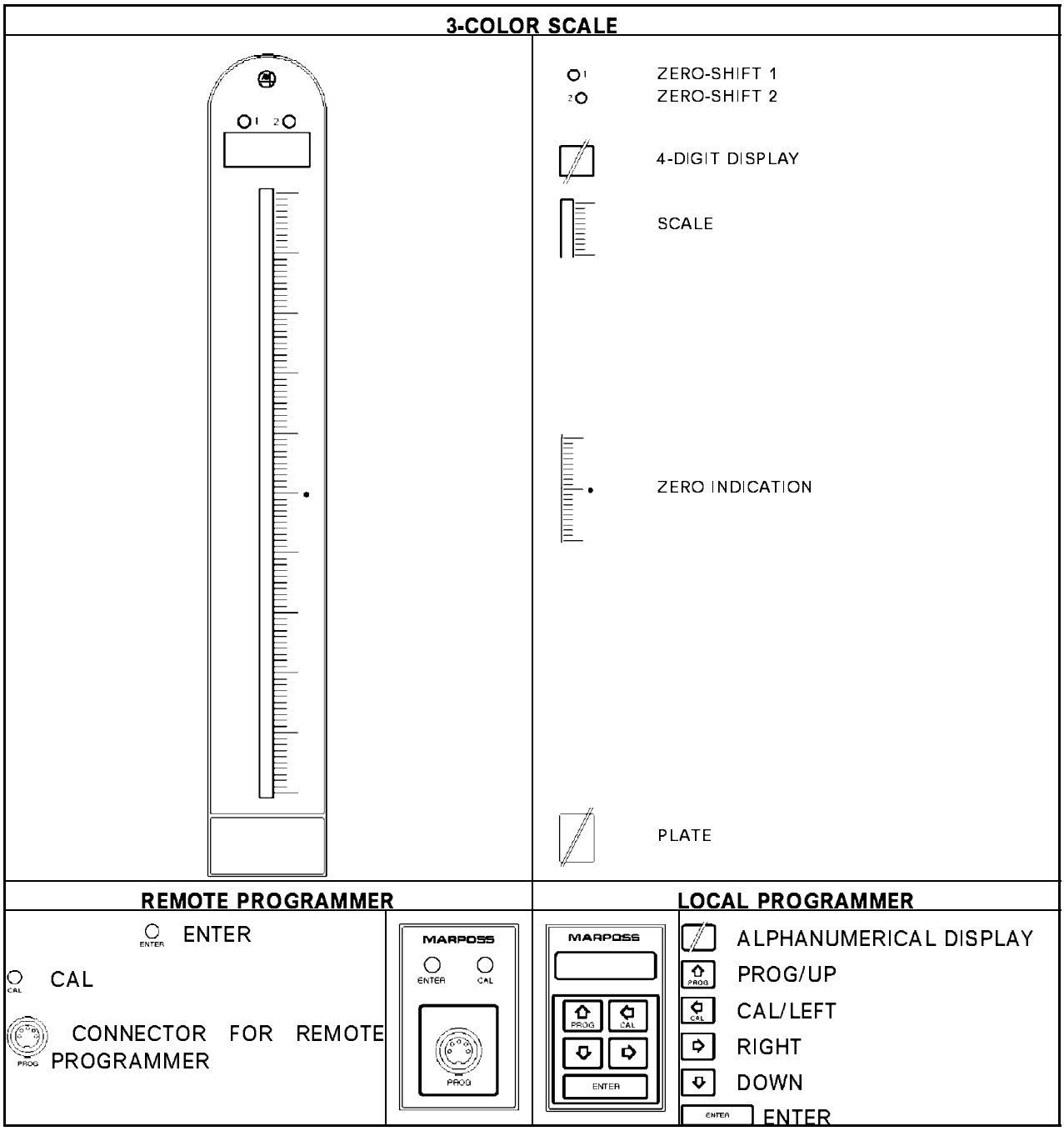
If an error is found, the relevant warning is given; to eliminate the warning, press ENTER (the calibration is aborted).

Chapter 7. Use of Column

7.1 Interface with the Operator

As regards the interface with the operator, 2 versions of the column are available:

1. with 3-COLOR scale and LOCAL programmer
2. with 3-COLOR scale and REMOTE programmer



The version with LOCAL programmer has a complete pushbutton panel on the column and an 8-digit alphanumerical display for programming and displaying the measurement and the class.

The version with REMOTE programmer has a reduced pushbutton panel with 2 pushbuttons, which is used for the current functions (calibration, adjustment, resetting of stored errors, switching between range and resolution), and a connector for the connection of the remote programmer.
The remote programmer can be:

- a personal computer equipped with E4N P.C.LINK software

The connection of the remote programmer uses some of the resources of the processor of the column, necessary for the serial RS232 interface.
So when the remote programmer is connected to the column, it is no longer possible to use the RS232 interface: any operations under way are aborted.

7.2 Self tests and column Identification

Once ended the stages:

- mechanical installation (2.1, “Mechanical Installation” on page 10)
- connection to the power supply (2.2, “Connection to power supply” on page 11)
- possible connection to the air supply network (2.3, “Connection to the air supply network” on page 13),

it is possible to switch on the column acting on the power supply switch.

SELF TESTS
Once switched on the column performs some self tests in order to verify that the basic functions for a correct functioning are active; the upper display shows the message ″TEST″.
The tests performed are:

- VISUAL CHECK OF THE DISPLAY MODE; the 2 displays and all the leds light up, the colors sequence range from RED, YELLOW and GREEN.
- EPROM CONTROL SUM; this test verifies if the bytes sum corresponds to the a predefined value. This test verifies if the EPROM has not been accidentally changed; in case of incongruities the error 110 is displayed.
- 2EPROM CONTROL SUM; as per the previous point; in case of incongruities the error 101 is displayed.
- RAM TEST; this test verifies the correct functioning of the RAM memory sending to it a value and reading it successively (READ AND WRITE). In case of incongruities the error 111 is displayed.
- ANALOGIC/DIGITAL CONVERTER TEST; the test foresees the calibration and the zero setting of the converter.
- AMPLIFIER MODULE TEST; the test verifies the compatibility between the programming resident on the column and the amplifier module; it is otherwise tested if the module is inserted, if not a warning message is given.
- SCALE TEST; this test verifies if the CPU of the LED scale is functioning and fits with the central CPU.

COLUMN IDENTIFICATION (E4N column with local programmer and display)
Once ended the self tests (about 10 seconds) the column displays two messages on the lower display:

- SW version installed on the column
- Column identification

7.3 Displaying of Measurement

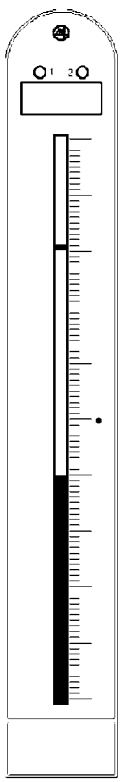
As a rule the measurement is displayed on the LED scale and on the lower display, when present. The resolutions of the LED scale and of the lower display are independent of each other, but it is possible to obtain a unique value for both the resolutions by entering the appropriate parameters during the programming.

The resolution of the LED scale depends on the **SCALE** value set in the programming; the resolution of the lower display depends on the **RESOLUTION** value set in the programming.

7.3.1 LED Scale

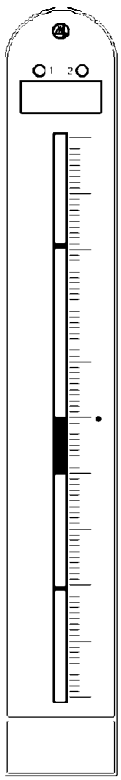
The scale is composed of 101 two-color LEDs which can become red, green and yellow-orange when measuring mode.

The scale can function in two ways, depending on the choice that has been made in the programming.

READING THAT STARTS FROM THE BOTTOM: The LEDS light up starting from the bottom of the scale toward the top, up to the measurement value.	

READING THAT STARTS FROM THE CENTER

The LEDs light up starting from the zero of the scale toward the top or toward the bottom, up to the measurement value.



The central LED of the scale always represents the zero of the measurement (the zero of the contact in ADJUSTMENT or the zero of the master gauge in CALIBRATION).

The color of the scale changes in relation to the status of the measurement (see 7.8, “Status of Measurement” on page 101), according to the following criterion:

GOOD WORKPIECE: Green scale:
measurement within tolerance limit;

SCRAP WORKPIECE: Red scale:
measurement out of tolerance limit;

PRE-SCRAP WORKPIECE: Yellow-orange scale:
measurement situated between tolerance pre-limit and tolerance limit.

Tolerance limits

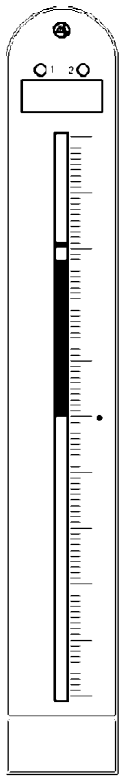
The tolerance limits, whose values have been entered during the programming, can be shown on the scale.
This display is obtained by means of a constantly underlit yellow-orange LED near the value of each limit.

If a tolerance limit coincides with the end of the scale the yellow-orange LED blinks.

Tolerance pre-limits

If both the tolerance limits and the pre-tolerance ones have been programmed, when the measurement causes the lighting up of the LEDS in the interval between the tolerance pre-limits and the tolerance limits, the entire scale becomes yellow-orange.

No permanent light indications relevant to the tolerance pre-limits are present on the scale. The entire scale becomes yellow-orange when the value of the measurement is between a tolerance limit and the relevant tolerance pre-limit.



Scale overrange

When the measurement is equal to a value not contained in the selected scale (overrange) but it is still valid because it is within the working range of the transducer, the scale presents some blinking red LEDs. If the measurement is invalid, the scale goes out, and the 7-segment display shows the message 'o.r.'.
The brightness of the scale can be programmed on 3 levels.

For each measurement it is possible to select a working range among the possible ones proposed by the programming (see 4.5.6, "Programming of Display Mode" on page 59).
Depending on which working range has been set, the LED scale has a resolution that is calculated as follows:

$$\text{scale resolution} = |\text{range}| / 100$$

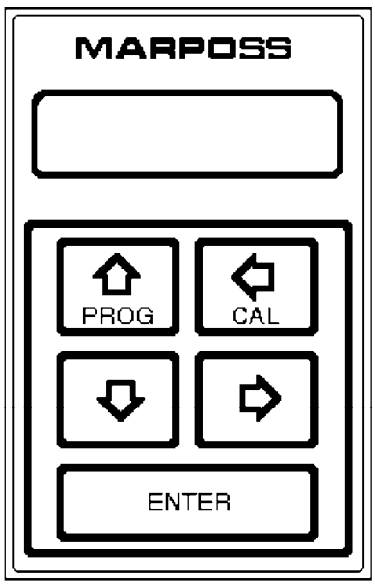
Example: range = +/- 500 μm

scale resolution = 1000 / 100 = 10 μm (for each LED)

7.3.2 Alphanumerical Display

(ONLY WHERE A MODULE FOR LOCAL PROGRAMMING IS PRESENT)

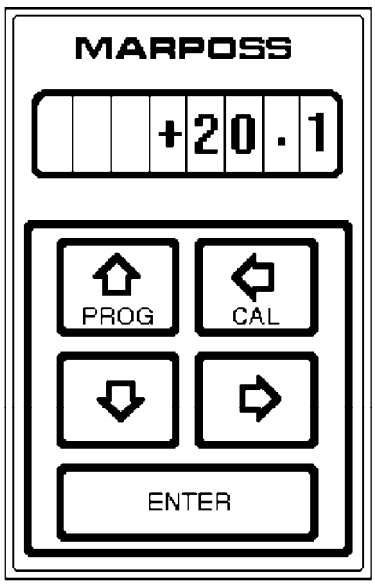
This is an 8-digit display which, in MEASURING MODE, represents the measurement in terms of digits. It can supply the sign indication and has a floating decimal point.



Depending on the choices made in the programming, this display can give several outputs:

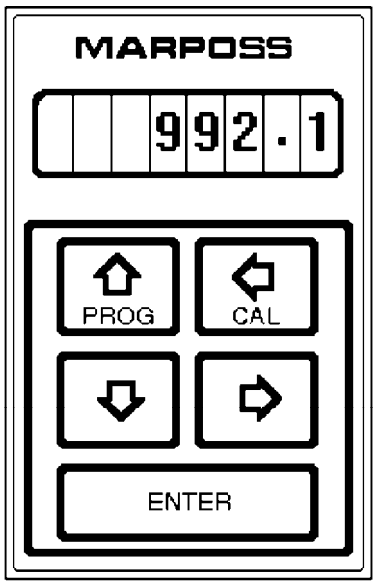
- In the case of a DIFFERENTIAL representation of the measurement, the display uses only the digits relevant to the whole and decimal figures (including the decimal point) that are required for a correct representation on the basis of the **RESOLUTION** selected during the programming.

The display shows a value that is calculated as:
CURRENT VALUE - NOMINAL VALUE
The display also shows the sign, which indicates whether the workpiece is too large (+) (see Figure) or too small (-) with respect to the nominal value.



- In the case of an ABSOLUTE representation of the measurement, the display uses only the digits relevant to the whole and decimal figures (including the decimal point) that are required for the correct representation on the basis of the **RESOLUTION** that has been set during the programming.

As the figure shows, in the case of an ABSOLUTE representation the display shows the absolute value of the workpiece that is being measured, calculated as follows:
NOMINAL VALUE + (CURRENT VALUE - NOMINAL VALUE)



In MEASURING MODE, if the ENTER key on the keyboard is kept pressed, the indication of the measurement value is switched to that of the measurement unit.

* • In measuring mode, in case of CLASSIFICATION of the measurement, automatically the alphanu-
* merical display shows the number associated to the class and not the measurement value.
* Anyway it is possible to see also in this case the measurement value but only if using manually the
* local keyboard.
* The procedure is the following:

* Start: on the alphanumerical display the class number is shown.

* * THE USER HAS TO	VISUALIZATION ON THE ALPHANUMERICAL DISPLAY
* Press the ENTER key	Measuring unit
* Release the ENTER key	Measuring value
* Press the ENTER key	Measuring unit
* Release the ENTER key	Class number

Resolution of alphanumerical display

As a general rule, the resolution of the alphanumerical display is the working resolution of the system. This means that, depending on the **RESOLUTION** that has been set during the programming, the display shows only the corresponding significant digits. This resolution controls the whole operation of the column for the tolerance limit, therefore also for the status of the measurement, the classification of the measurement, and the output signals.

The maximum resolution that can be obtained is:

- metric system = 0.1 μm
- imperial system = 5 millions

* **ERROR MESSAGE** Exiting the PROGRAMMING MODE and saving an incorrect programming, the alphanumerical display visualizes the message 'ERR.PROG.'.
The operator must return to the PROGRAMMING MODE to eliminate the error as the column does not allow to access the MEASUREMENT MODE in case of any error.

7.4 7-segment Display

In measuring mode the 4-digit-and-a-half display (7 segments with +/- sign and floating decimal point) displays the range or resolution of the LED scale, depending on the choice that has been made in the programming.

The range is represented by showing half of it on the display, preceded by the +/- indication.

±	5	0	0.	0

In MEASUREMENT MODE, when the ENTER key on the keyboard is kept pressed, the indication of the led scale range is switched to that of the led scale resolution (and viceversa).

	1	0.	0	0

If one or several transducers involved in the measurement are in overrange, that is out of the range of the programmed transducer, the 7-segment display shows the message "o.r."

		0.	r.	

In the other MODES (PROGRAMMING, CALIBRATION, ADJUSTMENT, HOLD, SEND, ERROR), the display shows strings that are characteristic of the current mode.

For example, if a calibration of the application is necessary in order to be able to proceed, the 7-segment display shows the message 'n.c.' (not calibrated).

		n.	c.	

In this case, the operator must perform the calibration; then he can pass to the MEASURING MODE.

Exiting the PROGRAMMING MODE and saving a not correct programming, the 7-segments display visualizes the message 'n.r.' (not ready).

		n.	r.	

In this case, the operator must return to the PROGRAMMING MODE in order to eliminate the error as the column does not allow to access the MEASURING MODE.

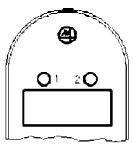
* In case of dynamic elaboration of the measurement, when the cycle is over (the run pushbutton is
* released) the column memorizes the value in HOLD mode.
* Consequentely the 7-segments display visualizes alternatively the messages:

* • HOLD
* • range or resolution that have been programmed

7.5 Upper LEDs 1 and 2

Two red LEDs are fitted in the upper part of the front panel. They have the following functions:

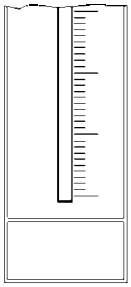
- in MEASURING MODE they indicate the ZERO SHIFT that has been selected;
- in PROGRAMMING MODE they indicate the number of the current measurement.



7.6 Adhesive Plates

Some adhesive plates are supplied with the column. Their purpose is to achieve a clearer description of the measurement that is performed. They must be placed in the expressly-made space on the front of the column.
The plates include:

- numbers from 0 to 9;
- measurement symbols conforming to international standards and to Marposs internal regulations;
- measurement unit: mm. and inches.



7.7 Measurement

The microprocessor-based E4N column can perform a static or dynamic measurement and determine the status or the class of the measurement.

The column has 8 analog channels. Up to 4 channels come from an AMPLIFIER CHANNEL on the front of the column, and up to 4 channels come from a BUS that makes it possible to use the signals of the same transducer in various columns.

For applications in which the 4 channels of the bus are not enough, T-shaped cables are provided which make it possible to send the signal of a transducer to the amplifier modules of two different columns.

Amplifier modules are provided for the following types of transducers:

LVDT		(1, 2 and 4 channels)
HBT	(Marposs - Tesa)	(1, 2 and 4 channels)
MRT		(1, 2 and 4 channels)
AIR		(1 channel)

The transducers must have a maximum sensitivity error of 1%.

For each channel that is used, it is necessary to program the type (normal $\pm$ 1 mm., wide $\pm$ 5 mm., pneumatic $\pm$100 μm), the measuring range of the contacts, and, if necessary, the arm ratio of the mechanical application and the setting of the sensitivity.

7.7.1 Static Measurement

The measurement formula can be programmed as a linear combination of the signals coming from up to 8 channels.

The measurement is valid if none of the transducers involved in the linear combination is in overrange. If the measurement is not valid, the analog scale goes out, and the 7-segment display shows the message 'o.r.'.

7.7.1.1 Automatic switching with 2 static measurements

Two measurements can be performed on the same column instead of 1, if the following conditions are met:

- the 2 measurements are obtained as linear combinations of different transducers;
- the total number of terms of the 2 linear combinations is smaller than, or equal to, 4.

§ The display is automatically switched between the two measurements, based on the validity of meas-
§ urement, that is measurement within the programmed "TR.RNG="

On the basis of one of these criteria, the following combinations can be specified:

1. no measurement meets the criterion;
2. only one measurement meets the criterion;
3. both the measurements meet the criterion.

In case 1, 'o.r' is displayed.
In case 2, the measurement that meets the criterion is displayed.
In case 3, 'o.r.' is displayed.

In the case of a static measurement, it is possible to connect a pushbutton box to the E4N or a footswitch, by means of a connector on its back (see 2.5, "Connection of an external pushbutton box and/or footswitch to one E4N column" on page 17).

7.7.1.2 Zero shift

A zero shift can be applied to the measurement. A zero shift is the following difference:

nominal dimension of workpiece - nominal dimension of master gauge

Two different zero shift values can be programmed. So the following cases are possible:

0 - no zero shift is applied;
1 - zero shift 1 is applied;
2 - zero shift 2 is applied.

An external pushbutton connected to an expressly-provided output port (see 2.5, "Connection of an external pushbutton box and/or footswitch to one E4N column" on page 17) allows the operator to select the zero shift to be applied to the measurement. The sequence is the following:

0 ------> 1 ------> 2 ------> 0 ------> ...

The zero shift that is applied is indicated by one of the two LEDs at the top of the column.

In the case of two automatically switching static measurements, however, the programming of the zero shift is unique.
The following example will clarify the concept:

For MEASURE 1 two ZERO SHIFTS, with defined values, have to be programmed;
For MEASURE 2 no ZERO SHIFT is necessary.
For both the ZERO SHIFTS of MEASUREMENT 2, in 'PROGRAMMING MODE', the zero value has to be inserted so as to annul them.

7.7.2 Dynamic Measurement

The measurement formula can be programmed as a linear combination of the signals coming from up to 8 channels.

One of the following 'dynamic processings' can be applied to the result of the linear combination:

M - maximum value of measurement;
m - minimum value of measurement;
(M+m)/2 - sum of maximum value and minimum value divided by 2;
M-m - difference between maximum value and minimum value;
(M-m)/2 - difference between maximum value and minimum value divided by 2.

In case of a dynamic measurement it is possible to connect the E4N column to a pushbutton box or a footswitch, by means of a connector located on the back side of the column (see 2.5, "Connection of an external pushbutton box and/or footswitch to one E4N column" on page 17).

By means of a selector switch, it is possible to enable or to disable the dynamic processing that has been programmed. When the dynamic processing is enabled, its operation is controlled by means of an external pushbutton or footswitch:

- when the pushbutton is released, the measurement value is held;
- when the pushbutton is pressed, the memories are initialized and the updating of the dynamic processing is activated.

The measurement is valid if none of the transducers involved in the linear combination is in overrange. If the measurement is not valid, the analog scale goes out, and an error message is given in the upper display of the column

7.7.2.1 Zero shift

A zero shift can be applied to the measurement or not. By zero shift we mean the following difference:

nominal dimension of workpiece - nominal dimension of master gauge

Two different zero shift values can be programmed.
So the following cases are possible:

0 - no zero shift is applied;
1 - zero shift 1 is applied;
2 - zero shift 2 is applied.

By means of an external pushbutton connected to an expressly-provided input port, the operator can select the zero shift to be applied to the measurement. The sequence is the following:

0 ------> 1 ------> 2 ------> 0 ------> ...

The zero shift that is applied is indicated by one of the 2 LEDS at the top of the column.

7.8 Status of Measurement

The current measurement is compared with its own tolerance limits and, if present, with the tolerance pre-limits, in order to determine its status.

If there are only the two tolerance limits, the following three cases are possible:

Red + status: if the measurement value is greater than the upper tolerance limit value;

Green status: if the measurement value is smaller than, or equal to, the upper tolerance limit, and greater than, or equal to, the lower tolerance limit value;

Red - status: if the measurement value is smaller than the lower tolerance limit value.

If the two tolerance pre-limits, which must be within the tolerance limits, are also present, five cases are possible:

Red + status: if the measurement value is greater than the upper tolerance limit value;

Yellow + status: if the measurement value is smaller than, or equal to, the upper tolerance limit, and greater than the upper tolerance pre-limit value;

Green status: if the measurement value is smaller than, or equal to, the upper tolerance pre-limit and greater than, or equal to, the lower tolerance pre-limit value;

Yellow - status: if the measurement value is smaller than the lower tolerance pre-limit and greater than, or equal to, the lower tolerance limit value:

Red - status: if the measurement value is smaller than the lower tolerance limit value.

The status of the measurement is indicated to the operator by means of a change in the color of the scale.

§ Obviously the association between measurement status and scale color is valid.

If the column is equipped with a relay card and the measurement is not classified, it is possible to supply output signals relevant to the status of the measurement (see 2.9.1, “RELAY-BCD output for the identification of the measurement status” on page 31).

7.9 Classification of Measurement

When a measurement belongs to a class, this means that its value is within a certain interval inside the tolerance limits. The comparison with the class limits is performed with the following criteria:

§ Red - if measurement < lower limit
§ Class A if lower limit < = measurement < limit AB
§ Class B if limit AB < = measurement < limit BC
§ .....
§ Class Z if limit YZ < = measurement < = upper limit
§ Red + if upper limit < measurement

The number of intervals can range from 1 to 26. The intervals may be all of the same size, or may have different sizes; to each interval there is associated a number (1....26) that is sent out. The output may also take on the following values:

00 - red - status;
27 - red + status;
30 - measurement invalid;
31 - measurement not performed.

§ If the gauge is equipped with a local programming module, and if the measurement is classified, in
§ MEASURING MODE the alphanumerical display shows the number associated to the current class.

The E4N column can be equipped with a BCD card which makes it possible to send the data relevant to the classes to an external user (see 2.9.2, “RELAY-BCD output for sorting into classes” on page 32).

* 7.10 Tolerance limits printing with DIGIMATIC device connected to * the column

* As DIGIMATIC output the E4N column is able to supply the two values relevant to the higher and lower * tolerance limits.

* Obviously the DIGIMATIC device connected to the column must be set so that in a position to read * and/or print the above values.

* The procedure, valid only in case the column is equipped with local programming module, is the fol- * lowing:

* • program the column with the DIGIMATIC output activated

* • simultaneously press UP and ENTER keys for at least 3 seconds

* • press the SEND key of the external keyboard or the value acquisition pushbutton on the DIGIMATIC * device to send the value of *higher tolerance limit* to the same device; such operation can be per- * formed only once

* • simultaneously press DOWN and ENTER keys for at least 3 seconds

* • press the SEND key of the external keyboard or the value acquisition pushbutton on the DIGIMATIC * device to send the value of *lower tolerance limit* to the same device; such operation can be per- * formed only once

£ Chapter 8. Programming Error Messages V2.72

When leaving the PROGRAMMING MODE, if the alphanumerical display shows an error message, that is EXXX, where XXX is the error code instead of the message SAVE, the operator can use the following list to rapidly identify the error made.
The list reports the error codes with the relevant descriptions.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
0	NO ERROR
1	PROGRAMMED VALUE OVR MAX • **Description:** error on editing phase and referring to one configuration value. The entered value is higher than the maximum allowed. There are specific maximum values, one for each range. • **Suggested Actions:** decrease the numerical value in object in order to respect the maximum available value in the range.
2	PROGRAMMED VALUE OVR MIN • **Description:** error on editing phase and referring to one configuration value. The entered value is lower than the minimum allowed. There are specific values, one for each range. • **Suggested Actions:** increase the numerical value in object in order to respect the minimum available value in the range.
3	PROGRAMMED VALUE OUT OF RANGE • **Description:** Error on editing phase referring to one configuration value. The value entered is not one of the admitted values. • **Suggested Actions:** Modification of the value, so that it falls again in its validity range
4	SEE ERROR 20
5	SEE ERROR 106
6	ERROR IN MASTERS • **Description:** the deviation between the min/max masters is too small, with respect to the tolerance limits. • **Suggested Actions:** correct the programmed value.
7	SEE ERROR 101
8	SEE ERROR 107
9	INCORRECT OPERATION OF RELAY/BCD MODULE • **Description:** the communication with the relay/BCD card takes place in an incorrect way. • **Suggested Actions:** switch the column off, then switch it on again; if the fault persists, contact the nearest Marposs service center.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
10	NOT ALLOWED ELABORATION • **Description:** the requested kind of elaboration is not compatible with the programmed number of measures: if the (double measure mode) autoswitch is active, the only allowed elaboration is static. It is also possible that the single measure mode is programmed and there is a tentative of programming the automatic switch. It is also possible that the single measure mode is programmed and the kind of elaboration is not yet programmed. • **Suggested Actions:** using the (double measure) automatic switch mode, it is necessary to use the static elaboration for both measures and it is possible to manage the switch level. It is also necessary to program the single measure mode to enable all the dynamic elaborations. In single measure mode it is necessary to specify the kind of elaboration.
11	MEASURING SYSTEM NOT PROGRAMMED • **Description:** the measuring system (i.e. metric or imperial) has been specified incorrectly on the configuration of a measure. • **Suggested Actions:** define the measuring system correctly.
12	ERROR ON THE LANGUAGE SELECTION • **Description:** the selected (entered) language is not available or not known. • **Suggested Actions:** select an available language.
13	MEAS.UNIT AND SYS.UNIT NOT COMPATIBLE • **Description:** the measuring system (metric or imperial) and the measuring unit (millimeter, micron, inch, ...) are not compatible. • **Suggested Actions:** modify the measuring system and/or the measuring unit in order to obtain their compatibility.
14	NUMBER OF MEASUREMENT NOT PROGRAMMED • **Description:** the selection: single or double measure is missing or incorrect (unknown) on the general configuration. • **Suggested Actions:** specify the correct meas. mode (single or double).
15	INVALID VALUE ON POWER-ON MODE • **Description:** the operation after the power-on (i.e. meas. mode or calibration mode) is missing or wrong. • **Suggested Actions:** define one of the two possible modes, which are available after the power-on.
16	ERROR IN THE COLUMN NAME • **Description:** the name given to the column is made up of a number of characters lower than 1 and higher than 8. • **Suggested Actions:** rename using a name of 1 to 8 characters.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
20	INCOMPATIBILITY WITH AMPLIFIER • **Description:** the installed amplifier module is not compatible with the selected configuration because of insufficient number of inputs selected, or because of transducer range selected (standard, wide) different from the one or ones specified. • **Suggested Actions:** make the programmed configuration compatible with the amplifier module selected, reducing the number of internal selected channels and/or selecting the transducer type used in the internal channel compatible with the amplifier module.
21	TRANSDUCER NUMBER NOT SPECIFIED • **Description:** configuring the required channels at least one transducer identification number has been programmed with an error value (e.g. lower than zero or higher than ninety-nine). • **Suggested Actions:** correct the transducer identification number (the reset is allowed).
22	SENSITIVITY ADJUSTMENT INADEQUATE • **Description:** configuring the requested channels, the sensitivity value of at least one transducer is missing or incorrect. • **Suggested Actions:** edit a correct value as sensitivity for the transducer.
23	UNSPECIFIED TRANSDUCER TYPE • **Description:** configuring the required channels, the type (standard, wide range) of at least one transducer is missing or incorrect. • **Suggested Actions:** edit the transducer type in the correct way.
24	TRANSDUCER RANGE MISSING • **Description:** configuring the required channels, the allowed range of at least one transducer is missing or with incorrect value. • **Suggested Actions:** edit the correct value for the valid transducer range.
25	MECHANICAL ARM RATIO MISSING • **Description:** configuring the required channels the mechanical arm ratio of at least one transducer is missing or incorrect. • **Suggested Actions:** introduce a correct transducer mechanical arm ratio value.
26	INSUFFICIENT CHANNELS BY SINGLE • **Description:** the total absence of enabled channels does not allow the single measuring mode. • **Suggested Actions:** make available the channel or channels to be used in the measuring formula.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
27	NOT ENABLED CHANNEL • **Description:** the error is shown every time access to a proper range of an enable channel is attempted. If the action is produced in the editing phase the display shows a warning that does not allow the access in the same range. At the same time it is not possible to get access to a parameter due to the fact that the above requires that at least one channel is enabled. • **Suggested Actions:** enable the channel on which the parameter must be programmed.
30	MEASURING UNIT NOT PROGRAMMED • **Description:** during the measurement configuration the measuring unit has not been specified correctly (millimeter, micron, inches, thousandths, millions, degrees, billions, grams). • **Suggested Actions:** program the measuring unit correctly.
31	MEAS. FORMULA SHARING COEFFICIENT • **Description:** defining the measuring formula coefficients, one or more channels are shared among two measurements: both measurement formulas show the coefficient of a same programmed channel at an allowed value (not reset value is allowed). • **Suggested Actions:** adjust the measuring coefficient to avoid channels being used on both measurements.
32	COEFFICIENT INCOMP. ON THE TWO MEAS. • **Description:** the whole input channel (local and on the bus) does not allow to perform the two separate measurements. The error is displayed when an attempt is made to actuate the two measurements (autoswitch) functioning and one of the two measurements is either without programmed channels or with more than four channels. • **Suggested Actions:** verify whether both measurements are using at least one channel and not more than four.
33	MEASUREMENT COEFFICIENT ERROR • **Description:** the value of at least one measurement is missing or incorrect. Otherwise at least one enabled channel has a reset coefficient (or the coefficients, when autoswitch is enabled). • **Suggested Actions:** if the channel is effectively used, select a correct numerical value (between -9.9999 and +9.9999), or disable the channel.
34	ZERO SHIFT ERROR • **Description:** The zero shift programmed for a measurement is missing or not correct. Furthermore, for a measurement where the presence of one or two zero shifts is foreseen, the value of one or both is missing or not correct. • **Suggested Actions:** correctly define the desired zero shift number or correctly program the foreseen zero shift.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
35	SCALE READING FILTERING ERROR • **Description:** the selected filtering mode (slow, normal, fast) for the scale reading is missing or wrongly programmed. • **Suggested Actions:** enter a correct dampening value.
36	NOMINAL VALUE ERROR • **Description:** the nominal value of a measurement has been programmed in a wrong way. • **Suggested Actions:** provide a value within a valid range to the nominal value of the measurement (the reset value is valid).
37	AUTOSWITCH THRESHOLD ERROR • **Description:** the threshold switching value from one measurement to the other (available only when the automatic switch between two measurements is present) is programmed at a wrong value. • **Suggested Actions:** edit (or program) a correct threshold value. (The reset value is authorized and allows the switching on the overrange value.)
38	NO RESOLUTION VALUE AVAILABLE • **Description:** the resolutions computation in automatic procedure does not identify any resolution range value compatible with the requested available range (standard or fine). The range can be kept reducing the valid range of one or more transducers used in the measurement. • **Suggested Actions:** if the resolution range selected (e.g. standard) must be kept, it is necessary to reduce the validity range of one or more transducers. It is furthermore possible to move to a less restrictive range or manually set the resolution value.
39	NO RESOLUTION VALUE SPECIFIED • **Description:** the resolution range of at least one measurement is not specified or is incorrect. • **Suggested Actions:** set a resolution range (in automatic or manual mode).
40	TOLERANCE NOT SET OR IMPROPERLY SET • **Description:** during a measurement configuration, one or both tolerance limits were not set, or set outside the validity range, or the lower tolerance limit was higher than the superior one. • **Suggested Actions:** set correct tolerance limit values.
41	SUPERIOR PRE-LIMIT INCORRECT • **Description:** the measurement pre-limit programmed value is incorrect because it is outside the validity range. The measurement upper tolerance limit is programmed below the lower pre-limit. • **Suggested Actions:** set a correct pre-limit value (leaving one or both pre-limits reset is allowed).

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
45	OVERTRAVEL CHECK • **Description**: the value considered by OTRV.CH= mode is not legal. • **Suggested Actions:** verify the programming parameter relevant to the OTRV.CH=
50	CLASS NUMBER INCORRECT • **Description:** the class number set for a measurement is incorrect (lower than zero, higher than twenty-six or still reset). • **Suggested Actions:** set a correct class number (set zero if no classification is required).
51	CLASS LIMIT OR THRESHOLD INCONVENIENT • **Description:** the threshold between two classes is missing, or incorrect because outside the validity range, or superior to the threshold limit relative to two other classes. • **Suggested Actions:** set the threshold limit, being sure to have value always between the tolerance limits and lower at eventual limits related to further classes.
52	CLASS INDEX INCORRECT • **Description:** the value set to an index class is incorrect or it is not set, even if it pertains to the group of classes. • **Suggested Actions:** set the index value properly.
53	CLASS TYPE ERROR • **Description:** The classification type (uniform or not uniform) is incorrect or badly set. • **Suggested Actions:** correct the classification type.
60	TYPE SCALE USED INCORRECT • **Description:** the range selected for a measurement is not compatible with the measuring unit and measuring system set. • **Suggested Actions:** select a correct range value.
70	VISUALIZATION OF MEAS. NOT SET • **Description:** the measurement visualization form (relative or absolute) is missing or incorrectly specified. • **Suggested Actions:** define a correct visualization form.
71	OPERATING SCALE MODE INCORRECT • **Description:** the way of visualization (from center or from bottom) is missing or incorrect. • **Suggested Actions:** set a correct way of visualization mode.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
72	LUMINOSITY INCORRECT • **Description:** the bargraph light intensity and digital display is not specified or incorrect. • **Suggested Actions:** select one among the three possible values (low, normal, high).
73	RANGE/RES. SELECTION INCORRECT • **Description:** the selected type of visualization on the seven segment display (+/- range or resolution) is missing or incorrect. • **Suggested Actions:** select one of the two possible ways of visualization relative to the upper seven segment display.
80	MASTERS INCORRECT • **Description:** the programmed calibration mode (master zero, quick, and so on...) is missing or incorrect. Otherwise one of: delta master, master max and master min is missing or incorrect for one measurement at least. When max and min master are requested, the min master could be higher or anyway too close to the max master. • **Suggested Actions:** set the calibration mode correctly.
81	LIMOVER INCORRECT • **Description:** the value relative to the max absolute displacement from the calibration zero is missing or with incorrect value. • **Suggested Actions:** the range as max absolute displacement from the calibration zero is limited as 5% of the measurement dynamic range. The parameter is missing or outside the valid threshold.
82	ZEROVER INCORRECT • **Description:** the value relevant to the max incremental displacement from the calibration zero is missing or of incorrect value. • **Suggested Actions:** set a correct parameter value.
90	BAUDRATE INCORRECT • **Description:** the baud-rate relevant to the application is missing or incorrect. • **Suggested Actions:** set a correct baud-rate for the application.
91	DATA BIT INCORRECT • **Description:** the data-bit number relative to a communication application is missing or incorrect. • **Suggested Actions:** set a correct number to the application data-bit.
92	PARITY SET INCORRECT • **Description:** the parity type of a communication application is missing or incorrect. • **Suggested Actions:** set a correct parity type for the application.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
93	SERIAL NODE SPECIF. INCORRECT • **Description:** an incorrect or not available datum has been set in the field selecting the serial communication application. • **Suggested Actions:** select a serial communication application among the available ones.
94	HANDSHAKE SPECIFICATION INCORRECT • **Description:** the handshake type required in the communication for a certain application is missing or incorrect. • **Suggested Actions:** select a correct form of handshake for the application.
95	SEPARATION HEAD NUMBER INCORRECT • **Description:** the number of separation lines relative to a communication application is missing or incorrect. • **Suggested Actions:** set a correct number of lines.
96	DIGIMATIC SPECIFICATION INCORRECT • **Description:** the specification to enable or disable the link with data acquisition lines Mitutoyo/DataMyte is missing or incorrect. • **Suggested Actions:** select a datum among the available two (active link or inactive link).
97	ERROR: RS232 NOT ENABLED • **Description:** no way of transmission (host, printer, etc..) was specified. It is not possible to have access to parameters describing the serial protocol. • **Suggested Actions:** enable the communication via RS232 specifying one among the possible protocols (i.e. host or printer).
98	ERROR IN HEADING LINE • **Description:** the control and heading string for the printer is made up of a number of characters lower than 1 and higher than 80. • **Suggested Actions:** set a string whose length is included between 1 and 80 characters.
99	ERROR IN LINE END • **Description:** in printer mode the page heading either consists of a pair of line-feed + carriage-return or of just a carriage-return. The error means that the line end that was set does not pertain to any of the two cases. • **Suggested Actions:** change the line end type.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
101	CHECKSUM INCORRECT • **Description:** the checksum relevant to the coded conf. in E2PROM is incorrect because of one of the following causes: power-off during the copying from E2PROM in RAM or from RAM to E2PROM; loading with remote programming of an already mixed up configuration; damaging of the E2PROM chip. • **Suggested Actions:** to proceed it is necessary either to reprogram the unit completely or to load a correct configuration in remote mode.
102	UNKNOWN MEASUREMENT IDENTIFICATION • **Description:** system software error: the current measurement identifier has an incorrect value. • **Suggested Actions:** report to the technical assistance and verify the error repeatability switching the equipment on and off.
103	UNRECOGNIZED PARAMETER • **Description:** software system error: an unrecognized programming parameter has been used. The error could be caused by the loading of a wrong configuration. • **Suggested Actions:** report to the technical assistance and verify the presence of the error either using the manual programming or loading a sure acceptable configuration.
104	RESET CONFIGURATION • **Description:** the default configuration (called also reset configuration) has been loaded into the E2PROM, and the programming must be completed. • **Suggested Actions:** either program the unit completely or load the configuration with a remote unit.
105	AMPLIFIER MODULE INCORRECT • **Description:** hardware/software system error: the system reads from the amplifier module an unidentified code. • **Suggested Actions:** report to the technical assistance.
106	FIRMWARE ERROR • **Description:** the configuration loaded into E2PROM comes from a different software version from the one present in the unit. The error can be avoided but it can reset the same configuration and the request for a complete reprogramming. • **Suggested Actions:** the error is avoided by pressing 'enter'. At the same time the reset configuration is automatically loaded, except for the case when the error is identified in a configuration loaded with a remote programmer.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
107	LINKMODE COMMUNICATION ERROR • **Description:** the system identifies a communication error during the upload or download phase. The system is not able to synchronize itself with the host during the serial linkage before the internal time-out expires (approx. 20 secs). • **Suggested Actions:** the error indication is removed by pressing 'enter'.
108	BARGRAPH COMMUNICATION ERROR • **Description:** hardware/software system error: the communication between the central or main processor and the bargraph processor is affected by errors. • **Suggested Actions:** report to the technical assistance trying to repeat the error switching the unit on and off.
109	ERROR IN COMMUNIC. WITH BCD • **Description:** system hardware/software error: errors in the current communication between central processor and relays unit. • **Suggested Actions:** report to the technical service and verify the repeatability of the error by switching the machine off and on again.
110	EPROM ERROR • **Description:** CHECKSUM error in EPROM. • **Suggested Actions:** report to the technical service and verify the repeatability of the error by switching the machine off and on again.
111	RAM ERROR • **Description:** an error was found on RAM during the test. • **Suggested Actions:** report to the technical service and verify the repeatability of the error by switching the machine off and on again.
200	MAX ZERO VARIATION EXCEEDED • **Description:** during the calibration procedure the zero constant in the measuring formula has been subjected to an increase as to the previous value and is higher than the zero in over programmed value (calibration menu). The error can be removed but it shows a thermal drift on the mechanical or electronic system. • **Suggested Actions:** the error can be removed just by pressing 'enter'.
201	MAX CUMULATIVE ERROR EXCEEDED • **Description:** during the calibration procedure the zero constant in the measurement formula has been increased as to its reset value, that is bigger than the LIMOVER programmed data (calibration menu). The error cannot be removed and could require a new mechanical reset. • **Suggested Actions:** go ahead in resetting the mechanical system, furthermore the calibration can be completed by increasing the LIMOVER parameter limit.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
202	SENSITIVITY VARIATION ERROR • **Description:** during each of the following calibration procedures: double master, zero master and max master, zero and min master, an adjustment of the sensitivity can be produced at a value of +/- 5%. The error cannot be canceled and it is caused by the wrong master dimensions or by a general deterioration of mechanical and/or electrical system components. • **Suggested Actions:** once the quality of the two masters has been verified, report to the technical assistance.
203	UNIT NOT CALIBRATED • **Description:** the unit has not completed the calibration cycle to allow entering in the measuring mode. From the non-calibrated unit status it is possible to get access to the following modes: set-up, calibration, adjust. • **Suggested Actions:** to move to measuring mode it is necessary to calibrate the unit (both measurements if the unit is set on two measurements).
204	MEASURE 1 NOT CALIBRATED • **Description:** in measurement mode with two measures (autoswitch) the unit has not completed the calibration cycle necessary to get in measurement mode 1. From the non-calibrated unit status it is possible to get access to the following modes: set-up, calibration, adjust. • **Suggested Actions:** to move to measuring mode it is necessary to calibrate the unit (both measurements if the unit is set on two measurements).
205	MEASURE 2 NOT CALIBRATED • **Description:** in measurement mode with two measures (autoswitch) the unit has not completed the calibration cycle necessary to get in measurement mode 2. From the non-calibrated status it is possible to get access to the following modes: set-up, calibration, adjust. • **Suggested Actions:** to move to measuring mode it is necessary to calibrate the unit (both measurements if the unit is set on two measurements).
302	VERSION ERROR • **Description:** the remote node uses a firmware whose version is different than the specified one. The version is represented by an 8-character string. • **Suggested Actions:** change the version.
303	OP CODE ERROR • **Description:** the remote node does not recognize the validity of the operative code of the control command transmitted to it by host. The error is probably due to inconsistency between the command sent and the software fitted on E4 - apply to the technical service. • **Suggested Actions:** use one of the commands available in the software used.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
304	OP CODE EXT ERROR • **Description:** the remote does not recognize the extension of the operative command code transmitted to it by host. The error is probably due to inconsistency between the command sent and the software fitted on E4 - apply to the technical service. • **Suggested Actions:** use one of the commands available in the software used.
305	PASSWORD ERROR • **Description:** the remote node asks a password to be transmitted to carry out the command required by host. • **Suggested Actions:** either include the password in the message or modify the password that had already been sent.
306	MEAS ID/CHECK EN ERROR • **Description:** the remote node does not recognize the value of the MEAS ID/CHECK EN range. Such a range serves both to specify a request for treatments, if any, and for the auxiliary functions. The error is probably due to inconsistency between the command sent and the software fitted on E4 - apply to the technical service. • **Suggested Actions:** use one of the commands available in the software used.
307	DATA LENGTH ERROR • **Description:** the remote node does not recognize the validity of the range that specifies the length of the data block of the message. The error is probably due to inconsistency between the command sent and the software fitted on E4 - apply to the technical service. • **Suggested Actions:** use one of the commands available in the software used.
308	ERROR IN COMPLEMENT TO 10 • **Description:** the remote node finds a value in range COMPLEMENT TO 10 that does not correspond to the one of range DATA LENGTH of the message. The error can be due to line troubles or inconsistency between the command sent and the software fitted on E4 - apply to the technical service. • **Suggested Actions:** use one of the commands available in the software used.
309	ERROR IN REQUEST FOR ACCESS • **Description:** the remote node received a request for access to a configuration parameter for which no transfer onto network is foreseen. • **Suggested Actions:** do not enter the parameter.

ERROR CODE	DESCRIPTION AND SUGGESTED ACTION
310	ERROR IN NUMERIC FORMAT • **Description:** the remote node received numeric data whose format does not correspond to the internal one. • **Suggested Actions:** correct the format by copying the one provided by the E4N system when it transmits to host.

Chapter 9. List of Spare Parts

	MARPOSS CODE	Description	EXPLODED REF.NO
£	6131910210	ABS UNIT + 3-COLOUR POLYESTER	1
	6344450200	REMOTE PROGRAMMING MODULE	2A
	6344450100	LOCAL PROGRAMMING MODULE	2B
§	6876004013	1 LVDT AMPLIFIER IMPLEMENTATION UNIT	3A
	6876004005	1 INPUT HBT AMPLIFIER STANDARD MARPOSS	3A
	6876004008	1 INPUT MRT AMPLIFIER	3A
§	6876004011	4 LVDT AMPLIFIER IMPLEMENTATION UNIT	3B
	6876004003	4 INPUTS HBT AMPLIFIER STANDARD MARPOSS	3B
	6876004006	4 INPUTS MRT AMPLIFIER	3B
§	6876004012	2 LVDT AMPLIFIER IMPLEMENTATION UNIT	3C
	6876004004	2 INPUTS HBT AMPLIFIER STANDARD MARPOSS	3C
	6876004007	2 INPUTS MRT AMPLIFIER	3C
*	6876004009	1 INPUT AIR/ELECTRONIC AMPLIFIER METRIC VERSION	3D
*	6876004010	1 INPUT AIR/ELECTRONIC AMPLIFIER NPT VERSION	3D
	1529040460	MEASUREM. SYNOPT. ADHESIVE PLATES	4
§	6735916001	EXT.CABLE FOR REMOTE PROGR.UNIT - PC PS/2 - XT (L=3mt)	5
§	6735957001	EXT.CABLE FOR REMOTE PROGR.UNIT - PC AT (L=3mt)	5
	1529040450	"PLUG" FOR AMPLIFIER MODULE CONNECTORS	7
§	6735932014	"Y" SHAPED EXTENSION FOR LVDT TRANSDUCERS (L=1.2mt)	7
§	6739796001	"Y" SHAPED EXTENSION FOR MRT TRANSDUCERS (L=1.2mt)	7
	6738536000	ADAPTER EXTENSION BETWEEN S3 FLYING PIN AND E4N FOR LVDT (L=40cm)	8
	6738536001	ADAPTER EXTENSION BETWEEN S7 FLYING PIN AND E4N FOR MRT (L=40cm)	8
£	6131910190	LEFT SHELL UNIT WITH RUBBER GASKET	9
	1529040480	SPECIAL SCREW FOR LEFT SHELL (5)	10
	1320254000	WRENCH FOR SPECIAL SCREW, CODE 1529040480	
§	6131910290	STEEL CHASSIS UNIT (WITH BUSHINGS TO FIX THE SCREWS)	11
	1529040080	REAR SUPPORT ANCHORS (2)	12
	1529040130	AUXILIARY CLOSING FOR BCD MODULE	13
	4358000017	SPRINGS LOCKING THE ABS BARGRAPH TO THE FRAME (9)	14
	1529040440	AMPLIFIERS CARD GUIDE (2)	15
	1529040470	FIXING HOOK (1)	16
	1529040070	SHELL SPACERS (4)	17
£	1529040630	CODE/SERIAL NUMBER + VOLTAGE/CURRENTS PLATE	18
£	6344410300	3-COLOR BARGRAPH MODULE	19
	4147101504	POWER SUPPLY UNIT (COMM.) ELCO PMC30E-2	20
	4143102000	FUSE 2A	21
§	6344180300	INPUT MODULE FOR VOLTAGE + NETWORK FILTER	22
	6739696029	POWER SUPPLY JUMPER	23
	6344360100	BCD RELAY MODULE	24

	MARPOSS CODE	Description	EXPLODED REF.NO
	6344600100	CPU CARD	25
	1529040020	STEEL COVER FOR INTERNAL CLOSURE OF THE CHASSIS	26
	6131900010	CONNECTION CABLE BETWEEN CPU AND POWER SUPPLY UNIT	27
	1529040030	RIGHT PLASTIC SHELL	28
	6739696034	POWER SUPPLY CABLE WITHOUT MAINS PLUG (L=2mt)	29
	6739696030	USA POWER SUPPLY CABLE (L=2mt)	30
	6739696031	SWISS POWER SUPPLY CABLE (L=2mt)	31
	6739696033	F - D POWER SUPPLY CABLE (L=2mt)	32
	6739696035	SPANISH POWER SUPPLY CABLE (L=2mt)	33
	6739696036	ITALIAN POWER SUPPLY CABLE (L=2mt)	34
	6131410040	REAR SUPPORT FOR COLUMNS UNIT	35
	1529040210	AUXILIARY PIN FOR COLUMN SUPPORT	36
	1529040090	CENTRAL PIN FOR COLUMN SUPPORT	37
	1526010070	"SAFETY RULES" PLATE	38
§	6738099016	MITUTOYO DP1-DP2-DP3 AND E4N EXTENS. CABLE (L=1mt)	39
§	6738039001	CONNECTION CABLE BETWEEN ONE E4N AND E68 A/D (L=3mt)	40
§	6739739024	CONNECTION CABLE BETWEEN TWO E4N AND E68 A/D (L=3mt)	41
§	6738049001	CONNECTION CABLE E4N-E68 A/D JUNCTION BOX (L=3mt)	42
	6737916000	CONNECTION CABLE RS232 OF TYPE PC PS/2-XT (L=3mt)	43
	6737957002	CONNECTION CABLE RS232 OF TYPE PC AT (L=3mt)	43
§	6738057011	BUS CABLE	44
§	6738099015	FOOTSWITCH FOR DYNAMIC CYCLE (cable L=2mt)	45
§	6139012600	EXTERNAL PUSH-BUTTON BOX (cable length=1.5mt)	46

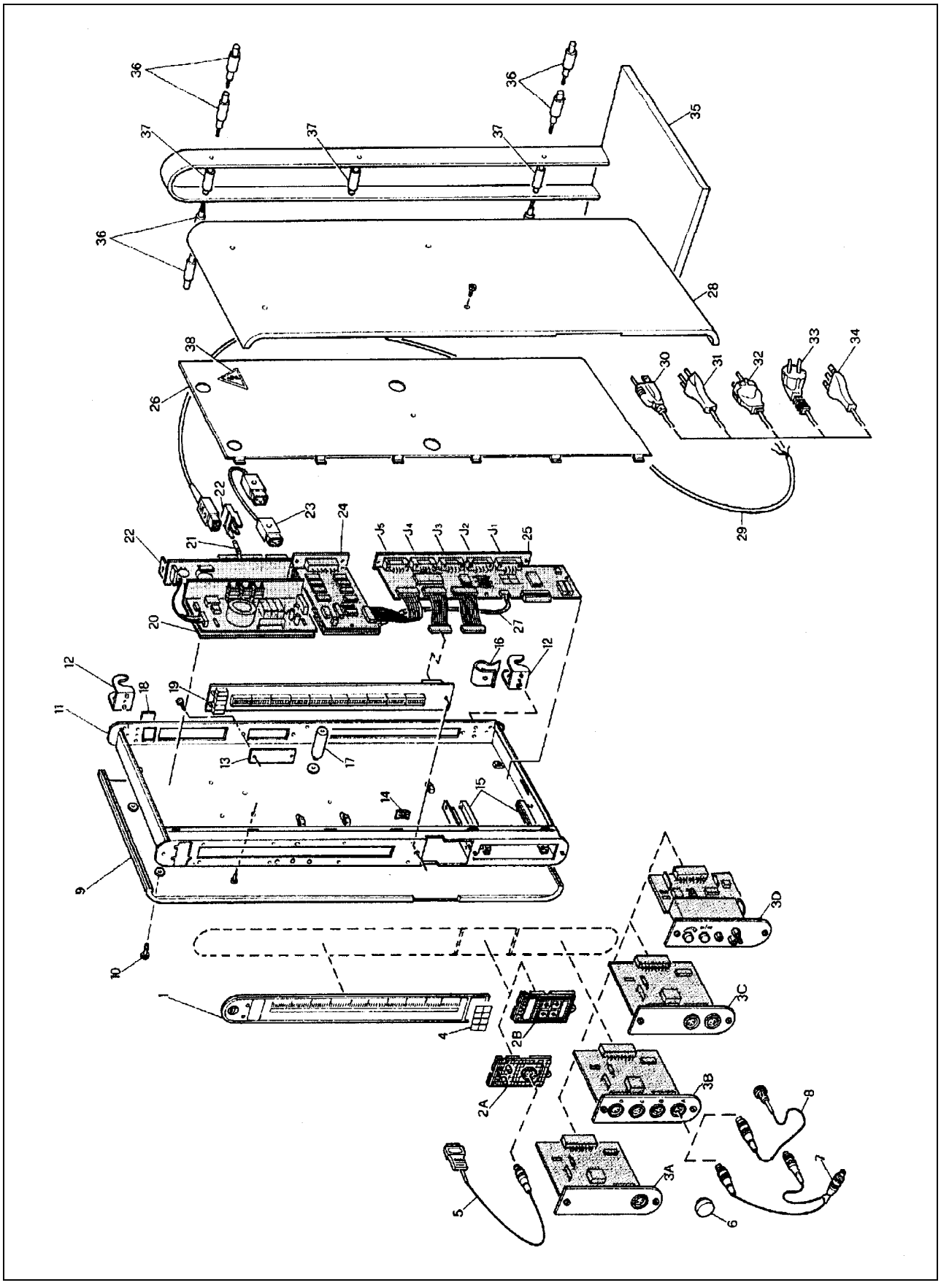
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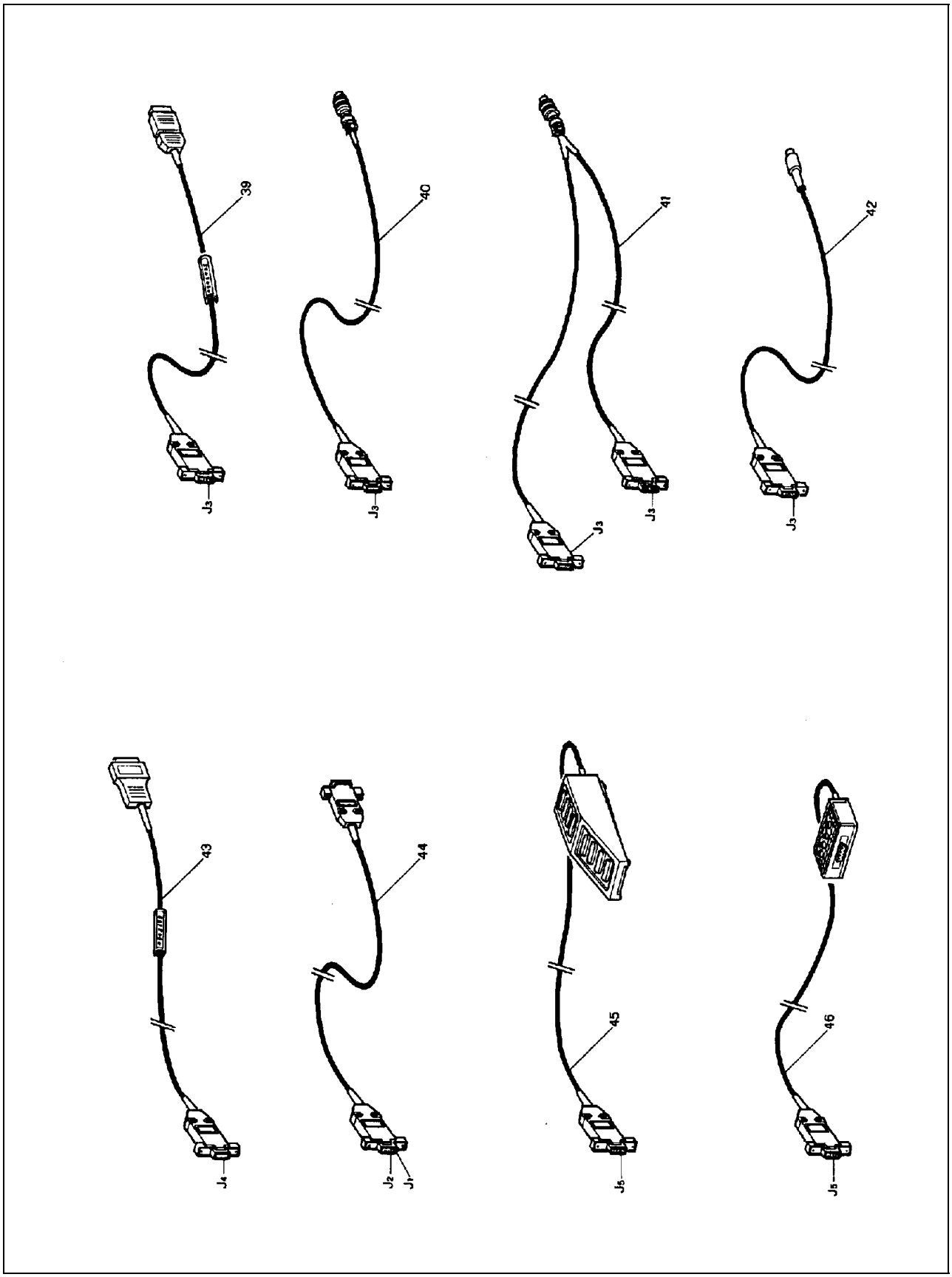
OTHER COMPONENTS

	MARPOSS CODE	Description
§	4140M00005	COVER FOR CANNON 9P SOCKET
§	4140M00006	COVER FOR CANNON 9P SOCKET
§	4140M00007	COVER FOR CANNON 25P SOCKET
	4325040805	LOCKING SCREWS FOR RIGHT SHELL (5)
	4326040641	FIXING SCREWS OF POWER SUPPLIER TO CHASSIS (2)
	4327798104	CARDS/FRAME LOCKING SCREWS (13)
	4327798110	BARGRAPH/FRAME LOCKING SCREWS (2)
£	S000420021	STANDARD SOFTWARE
§	6738098009	CABLE FOR ANALOG OUTPUT CONNECTION (L=3mt)
	6738036000	ADAPT.CABLE BETWEEN E4 AND E4N ANALOG OUTPUTS (L=30cm)
	92162*	DIGIMATIC OUTPUT-DATA MYTE 862 CONNECTION CABLE
	92160*	DIGIMATIC OUTPUT-DATA MYTE 529-15 CONNECTION CABLE
§	6738097009	CABLE CONNECTING 2 "E4N" TO EXT.PUSH-BUTTON BOX (OR FOOT-SWITCH)
§	6738097010	CABLE CONNECTING 3 "E4N" TO EXT.PUSH-BUTTON BOX (OR FOOT-SWITCH)

	MARPOSS CODE	Description
§	6738097011	CABLE CONNECTING 4 "E4N" TO EXT.PUSH-BUTTON BOX (OR FOOT-SWITCH)
§	6738097012	CABLE CONNECTING 5 "E4N" TO EXT.PUSH-BUTTON BOX (OR FOOT-SWITCH)
	6739797021	CABLE CONNECTING 2 "E4N" TO P.C. VIA RS232
	6739797020	CABLE CONNECTING 3 "E4N" TO P.C. VIA RS232
	6739797019	CABLE CONNECTING 4 "E4N" TO P.C. VIA RS232
	6739797018	CABLE CONNECTING 5 "E4N" TO P.C. VIA RS232
	2915490053	FILTERING AND AIR REGULATION UNIT FOR 1 COLUMN
	2915490052	TWO 90° QUICK CLUTCH NIPPLES
	2915490050	TWO STRAIGHT CLUTCH NIPPLES
§	1015420614	ASSEMBLY OF 10 COVERS FOR SENSITIVITY KNOB PROTECTION
§	1015420615	ASSEMBLY OF 10 COVERS FOR SENSITIVITY AND ZERO KNOBS PROTECTION
£	C004I00010	E4N PC-LINK 2.72 WIN-LINK - ITALIAN LANGUAGE
£	C004G00010	E4N PC-LINK 2.72 WIN-LINK - ENGLISH LANGAUGE
£	C004D00010	E4N PC-LINK 2.72 WIN-LINK - GERMAN LANGUAGE
£	C004E00010	E4N PC-LINK 2.72 WIN-LINK - SPANISH LANGUAGE
£	C004F00010	E4N PC-LINK 2.72 WIN-LINK - FRENCH LANGUAGE
£	D2040027D1	E4N MANUAL FOR PROGRAMMING AND USE IN GERMAN (VERS. 2.72)
£	D2040027E1	E4N MANUAL FOR PROGRAMMING AND USE IN SPANISH (VERS. 2.72)
£	D2040027F1	E4N MANUAL FOR PROGRAMMING AND USE IN FRENCH (VERS. 2.72)
£	D2040027I1	E4N MANUAL FOR PROGRAMMING AND USE IN ITALIAN (VERS. 2.72)
£	D2040027U1	E4N MANUAL FOR PROGRAMMING AND USE IN ENGLISH (VERS. 2.72)
	Note: * - DATAMYTE code	

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J5
J4
J3
J2
J1
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2B
2A
3D
3C
3B
3A
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J3
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J3
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J3
J3
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J3
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J4
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J2
J1
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J5
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J5

Appendix A. Programming Sheets for E4N Column

E4N - APPLICATION DATA

GENERAL:

	LANGUAG =	[ ]ENGLISH
		[ ]ITALIANO
		[ ]FRANCAIS
		[ ]DEUTSCH
		[ ]ESPANOL
	M.SYST =	[ ] METRIC
		[ ] IMPERIAL
	ASWITCH =	[ ] SINGLE
		[ ] DOUBLE
	POWERON =	[ ] MEASURE
		[ ] CALIBR
£	O.R.CK =	[√] OFF
£		[ ] ON
	IDENTIF =	[_____]

SHEET 1/8

E4N - APPLICATION DATA

CHANNEL:

CH.A:

SELECT=	+ Ifk.] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE=	[ ] NORMAL
	[ ] WIDE RNG
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

CH.B:

SELECT=	[ ] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE=	[ ] NORMAL
	[ ] WIDE RNG
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

CH.C:

SELECT=	[ ] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE=	[ ] NORMAL
	[ ] WIDE RNG
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

CH.D:

SELECT=	[ ] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE=	[ ] NORMAL
	[ ] WIDE RNG
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

CHANNEL: (continue)

CH.BUS1:

SELECT=	[ ] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE=	[ ] NORMAL
	[ ] WIDE RNG
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

CH.BUS2:

SELECT=	[ ] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE	[ ] NORMAL
	[ ] WIDE RNG=
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

CH.BUS3:

SELECT=	[ ] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE=	[ ] NORMAL
	[ ] WIDE RNG=
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

CH.BUS4:

SELECT=	[ ] ON
	[ ] OFF
TR.NUM=	[__]
TR.TYPE=	[ ] NORMAL
	[ ] WIDE.RNG=
	[ ] PNEUM
SEN.ADJ=	[_.___]
TR.RNG=	[____]
A.RATIO=	[_.___]

E4N - APPLICATION DATA

MEAS.N.1

MEASURE:

	M.UNIT =	[ ] MM [ ] MICRON [ ] DEGREE [ ] MILLRAD [ ] GRAM [ ] INCH [ ] THOUSAND [ ] MILLIONS
	M.TYPE =	[ ] STATIC [ ] MAX [ ] min [ ] (M + m)/2 [ ] (M-m)/2 [ ] M-m
	RESPON =	[ ] FAST [ ] NORMAL [ ] SLOW
£	A.S.LEV =	[ ]]
	K.CH.A =	[_.____]
	K.CH.B =	[_.____]
	K.CH.C =	[_.____]
	K.CH.D =	[_.____]
	K.BUS1 =	[_.____]
	K.BUS2 =	[_.____]
	K.BUS3 =	[_.____]
	K.BUS4 =	[_.____]
	SHIFT# =	[ ] NONE [ ] ONE [ ] TWO
	SHIFT1 =	[____]
	SHIFT2 =	[____]
	RESOLUT =	[ ] STANDARD [ ] FINE [ ] MAXIMUM [____]

TOLER :

+TOLER =	[_____]
-TOLER =	[_____]
+APPRCH =	[_____]
-APPRCH =	[_____]

SHEET 3/8

E4N - APPLICATION DATA

MEAS.N.1

CLASS :

CLASS# =	[__]
CL.TYPE =	[__] EQUAL [__] NOTEQUAL
LIM A/B =	[_____]
LIM B/C =	[_____]
LIM C/D =	[_____]
LIM D/E =	[_____]
LIM E/F =	[_____]
LIM F/G =	[_____]
LIM G/H =	[_____]
LIM H/I =	[_____]
LIM I/J =	[_____]
LIM J/K =	[_____]
LIM K/L =	[_____]
LIM L/M =	[_____]
LIM M/N =	[_____]
LIM N/O =	[_____]
LIM O/P =	[_____]
LIM P/Q =	[_____]
LIM Q/R =	[_____]
LIM R/S =	[_____]
LIM S/T =	[_____]
LIM T/U =	[_____]
LIM U/V =	[_____]
LIM V/W =	[_____]
LIM W/X =	[_____]
LIM X/Y =	[_____]
LIM Y/Z =	[_____]

CLASS : (continue)

IND A =	[__]
IND B =	[__]
IND C =	[__]
IND D =	[__]
IND E =	[__]
IND F =	[__]
IND G =	[__]
IND H =	[__]
IND I =	[__]
IND J =	[__]
IND K =	[__]
IND L =	[__]
IND M =	[__]
IND N =	[__]
IND O =	[__]
IND P =	[__]
IND Q =	[__]
IND R =	[__]
IND S =	[__]
IND T =	[__]
IND U =	[__]
IND V =	[__]
IND W =	[__]
IND X =	[__]
IND Y =	[__]
IND Z =	[__]

E4N - APPLICATION DATA

MEAS.N.1

SCALE = [_____]

DISPLAY

LUMIN = [__] HIGH
[__] NORMAL
[__] LOW

* NOM.VAL= [_____]

MODE= [__] CENTRAL
[__] BOTTOM

RNG-RES= [__] RANGE
[__] RESOLUT

* MASTER :

CALMODE= [__] QUICK
[__] SINGLE
[__] 1(M) or 2
[__] 1(m) or 2

DELTA = [_____]
DELTA M= [_____]
DELTA m= [_____]

ZEROVER= [_____]
LIMOVER= [_____]

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E4N - APPLICATION DATA

MEAS.N.2

MEASURE:

M.UNIT= [ ] MM
[ ] MICRON
[ ] DEGREE
[ ] MILLRAD
[ ] GRAM
[ ] INCH
[ ] THOUSAND
[ ] MILLIONS

M.TYPE = [ ] STATIC
[ ] MAX
[ ] min
[ ] (M + m)/2
[ ] (M-m)/2
[ ] M-m

RESPON = [ ] FAST
[ ] NORMAL
[ ] SLOW

£ A.S.LEV = [ ]

K.CH.A = [_.____]
K.CH.B = [_.____]
K.CH.C = [_.____]
K.CH.D = [_.____]
K.BUS1 = [_.____]
K.BUS2 = [_.____]
K.BUS3 = [_.____]
K.BUS4 = [_.____]

SHIFT#= [ ] NONE
[ ] ONE
[ ] TWO
SHIFT1 = [____]
SHIFT2 = [____]

RESOLUT= [ ] STANDARD
[ ] FINE
[ ] MAXIMUM
[____]

TOLER :

+TOLER = [_____]
-TOLER = [_____]
+APPRCH= [_____]
-APPRCH= [_____]

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E4N - APPLICATION DATA

MEAS.N.2

CLASS :

CLASS# = [__]
CL.TYPE = [__] EQUAL
[__] NOTEQUAL
LIM A/B = [_____]
LIM B/C = [_____]
LIM C/D = [_____]
LIM D/E = [_____]
LIM E/F = [_____]
LIM F/G = [_____]
LIM G/H = [_____]
LIM H/I = [_____]
LIM I/J = [_____]
LIM J/K = [_____]
LIM K/L = [_____]
LIM L/M = [_____]
LIM M/N = [_____]
LIM N/O = [_____]
LIM O/P = [_____]
LIM P/Q = [_____]
LIM Q/R = [_____]
LIM R/S = [_____]
LIM S/T = [_____]
LIM T/U = [_____]
LIM U/V = [_____]
LIM V/W = [_____]
LIM W/X = [_____]
LIM X/Y = [_____]
LIM Y/Z = [_____]

CLASS : (continue)

IND A = [__]
IND B = [__]
IND C = [__]
IND D = [__]
IND E = [__]
IND F = [__]
IND G = [__]
IND H = [__]
IND I = [__]
IND J = [__]
IND K = [__]
IND L = [__]
IND M = [__]
IND N = [__]
IND O = [__]
IND P = [__]
IND Q = [__]
IND R = [__]
IND S = [__]
IND T = [__]
IND U = [__]
IND V = [__]
IND W = [__]
IND X = [__]
IND Y = [__]
IND Z = [__]

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E4N - APPLICATION DATA
MEAS.N.2.

SCALE = [_____]

DISPLAY

LUMIN = [__] HIGH
[__] NORMAL
[__] LOW

* NOM.VAL= [_____]

MODE= [__] CENTRAL
[__] BOTTOM

RNG.RES= [__] RANGE
[__] RESOLUT

* MASTER :

CALMODE= [__] QUICK
[__] SINGLE
[__] 1(M) or 2
[__] 1(m) or 2

DELTA = [_____]

DELTA M= [_____]

DELTA m= [_____]

ZEROVER= [_____]

LIMOVER= [_____]

E4N - APPLICATION DATA

COMM :

DIGIMAT= [__] ON
* [__] ON W/O S
[__] OFF

* RS232 = [__] OFF
[__] PRINT
[__] HOST

BAUDR= [__]300
[__]600
[__]1200
[__]2400
[__]4800
[__]9600

DATABIT= [__]7 BIT
[__]8 BIT

PARITY = [__]NONE
[__]EVEN
[__]ODD

HANDSH= [__]NONE
[__]HARDWARE
[__]XON/XOFF

LINE/P= [__]

LINTERM= [__]CR
[__]CR+LF

TEXT= [_____
_____
_____]

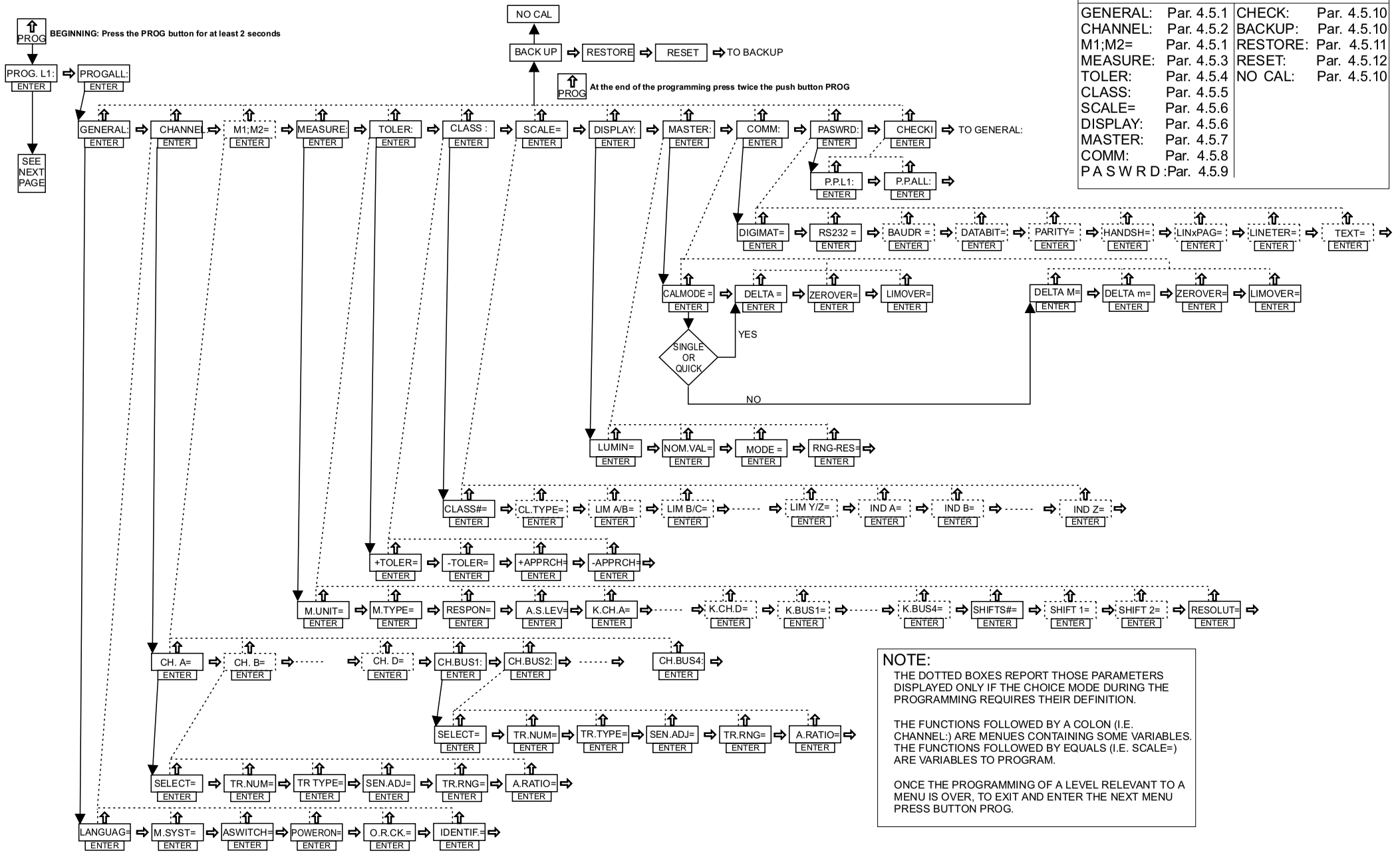
PASWRD:

P.P. L1= [____]

P.P.ALL= [____]

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Appendix B. Programming Flow Charts



INSTRUCTION MANUAL REFERENCES

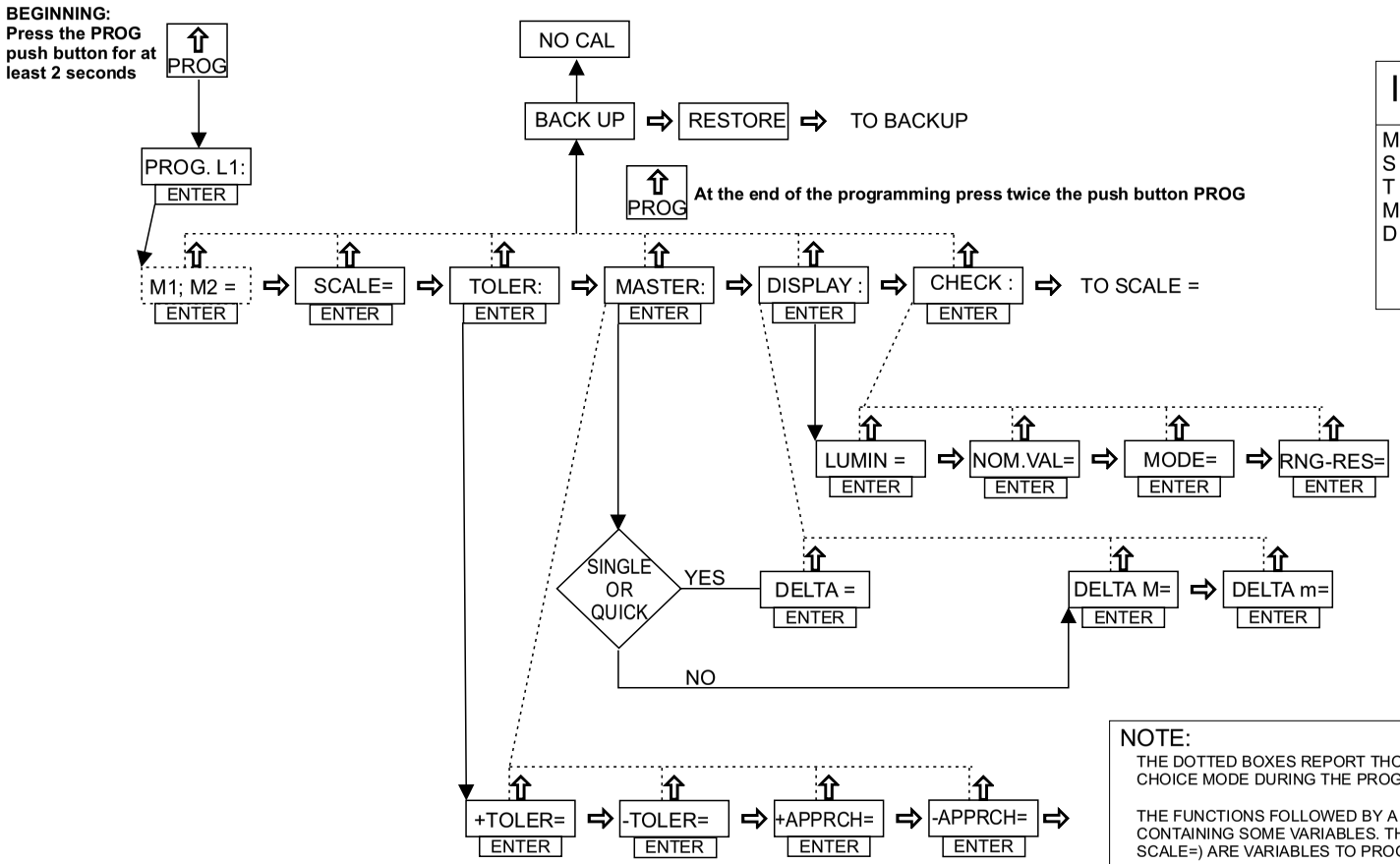
GENERAL:	Par. 4.5.1	CHECK:	Par. 4.5.10
CHANNEL:	Par. 4.5.2	BACKUP:	Par. 4.5.10
M1;M2=	Par. 4.5.1	RESTORE:	Par. 4.5.11
MEASURE:	Par. 4.5.3	RESET:	Par. 4.5.12
TOLER:	Par. 4.5.4	NO CAL:	Par. 4.5.10
CLASS:	Par. 4.5.5		
SCALE=	Par. 4.5.6		
DISPLAY:	Par. 4.5.6		
MASTER:	Par. 4.5.7		
COMM:	Par. 4.5.8		
P A S W R D :	Par. 4.5.9		

NOTE:

THE DOTTED BOXES REPORT THOSE PARAMETERS DISPLAYED ONLY IF THE CHOICE MODE DURING THE PROGRAMMING REQUIRES THEIR DEFINITION.

THE FUNCTIONS FOLLOWED BY A COLON (I.E. CHANNEL:) ARE MENUES CONTAINING SOME VARIABLES. THE FUNCTIONS FOLLOWED BY EQUALS (I.E. SCALE=) ARE VARIABLES TO PROGRAM.

ONCE THE PROGRAMMING OF A LEVEL RELEVANT TO A MENU IS OVER, TO EXIT AND ENTER THE NEXT MENU PRESS BUTTON PROG.



INSTRUCTION MANUAL REFERENCES

M1;M2=	Par. 4.5.1	CHECK:	Par. 4.5.10
SCALE=	Par. 4.5.6	BACKUP:	Par. 4.5.10
TOLER=	Par. 4.5.4	RESTORE:	Par. 4.5.11
MASTER=	Par. 4.5.7	NO CAL:	Par. 4.5.10
DISPLAY:	Par. 4.5.6		

NOTE:

THE DOTTED BOXES REPORT THOSE PARAMETERS DISPLAYED ONLY IF THE CHOICE MODE DURING THE PROGRAMMING REQUIRES THEIR DEFINITION.

THE FUNCTIONS FOLLOWED BY A COLON (I.E. CHANNEL:) ARE MENUES CONTAINING SOME VARIABLES. THE FUNCTIONS FOLLOWED BY EQUALS (I.E. SCALE=) ARE VARIABLES TO PROGRAM.

ONCE THE PROGRAMMING OF A LEVEL RELEVANT TO A MENU IS OVER, TO EXIT AND ENTER THE NEXT MENU PRESS BUTTON PROG.

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